# Second-Growth Timber Opportunities on Haida Gwaii /QCI

July 2004

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## Acknowledgements

This report was developed with information from two sources: interviews with the staff of licensees, BC Timber Sales, log and lumber traders, and consultants; and forest inventory information provided by the Ministry of Sustainable Resource Management (MSRM). The members of the project team wish to express their gratitude to the participants in the interview process who provided their observations and expert opinions to the project. The help of John Sunde (MSRM) in acquiring the inventory data coverages is also gratefully acknowledged.

We are also grateful to Les Jozsa (Forintek, ret.) and Brian Zak (CFLA) who patiently explained their insights regarding the technical characteristics of the second-growth logs from Haida Gwaii, and the history and prospects of developing markets for their products. QCI Forest District made available to the project team a key document on the technical properties of Sitka spruce.

Glenn Farenholtz (MSRM) was the technical contact for the project, and participated in the development of the report, contributing both analysis and text.

John Cookman (HiMark Forest Consultants Ltd.) conducted the interviews for the project team and synthesized much of the operational and market content of the report. Mike Buell (Cortex Consultants Inc.) undertook the GIS analysis of the forest inventory, produced the maps and data tables, and modeled the potential harvest opportunity for the second-growth resource. Audrey Roburn and Doug Williams (both of Cortex Consultants Inc.) integrated the inventory- and interview-based information, and developed this report, with input from members of the project team. Doug Williams managed the project.

Finally, the advice and patience of the contract authority, Leah Malkinson, is also gratefully appreciated by the project team.

# Executive Summary

## Introduction

The objective of this study was to compile information on the value of second-growth timber and to establish the location, extent, and economic operability of the second-growth resource for consideration by the HG/QCI Land Use Planning forum. Although environmental concerns regarding the harvest of second growth are a key consideration for the HG/QCI LUP forum, they are outside the scope of this study.

In the first part of this study, we interviewed licensees, log traders and researchers to obtain their advice regarding the marketability, value, productivity, operability, and other economic characteristics of the second-growth resource.

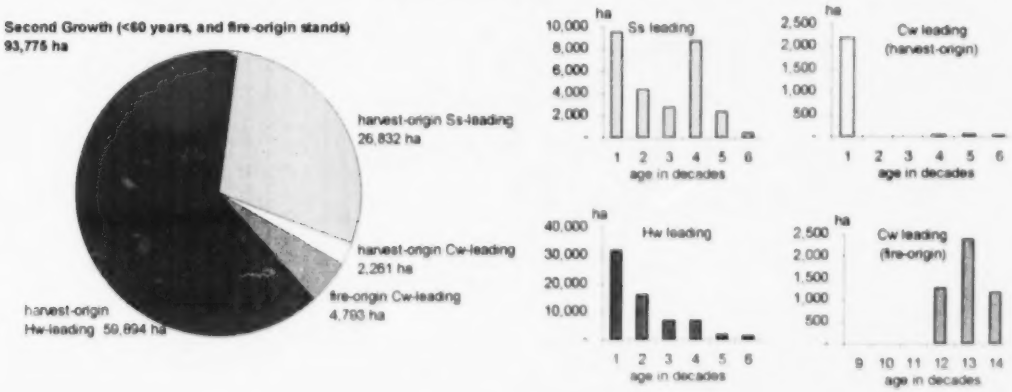
The second part of this study used the information gathered to modify the forest type classifications, and volume and revenue yield tables of an existing timber supply model – the CIT EGSA Timber model (Williams and Buell, 2004). We used the dataset and model to generate maps and tables of the second-growth resource and determine the volume of logs available at the earliest feasible harvesting age of the second-growth stands. However, this study is not a timber supply analysis – the second growth was not scheduled for harvest in the context of the remaining old growth, and constraints on forest practices (e.g., block adjacency, biodiversity) were not considered.

## Second-Growth Forests of Haida Gwaii /QCI

For the purposes of this study, we have defined the second-growth forest as harvest-origin stands of age ≤ 60 years, plus stands that regenerated naturally after the Tlell fire.

The second-growth forest is large and constitutes 39% of the total landbase currently considered operable and available for timber harvesting. It is also highly productive, and a recent study found that harvest-origin stands in the Queen Charlotte Timber Supply Area (TSA) are growing two to seven times faster than was assumed in the most recent TSR. Sitka spruce, in particular, is a fast growing species on moist, well-drained sites.

**Figure E-1. Components of the second-growth forest of Haida Gwaii/Queen Charlotte Islands.**



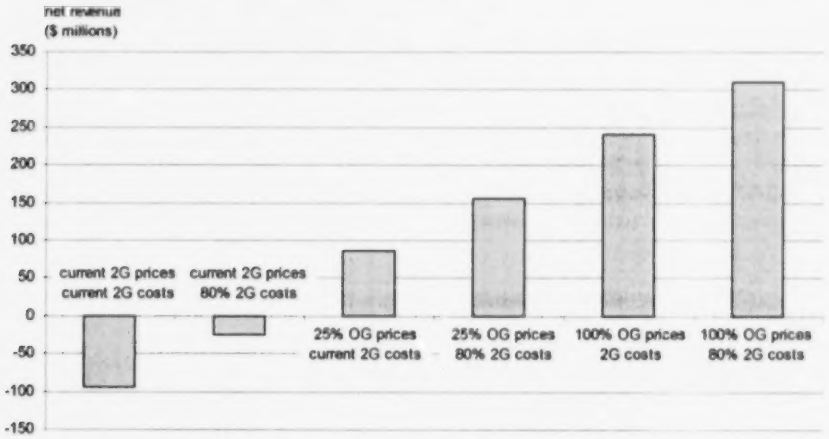
In the interviews that informed this study, the licensees focused on three aggregations of the second-growth forest types and stand origins shown in Figure E-1: fire-origin cedar-leading stands, harvest-origin hemlock-leading stands, and harvest-origin spruce-leading stands. We have added a fourth aggregation – harvest-origin cedar-leading stands – to fully account for the second-growth resource. These aggregations of stands are referred to as the components of second growth in the main body of this report.

### Potential Revenue

Although the physical dimension of the second growth resource is impressive, its economic operability is questionable. To explore this issue we estimated the value of the second-growth resource over the next 10-20 years under a variety of price and cost assumptions. The value of the resource was calculated as its net revenue – the market value for logs minus the costs of their harvesting and transportation. Stumpage paid to the Crown was not included.

Note that the costs used in this study are broad averages of costs experienced by licensees and do not accurately represent any specific situation. However, we find that these modeled costs are useful for examining the "big picture" about the value of the second-growth resource. The results of this analysis are presented in Figure E-2.

**Figure E-2. Value of the existing second-growth resource 10-20 years from now, under various cost and price assumptions.**




Explanation of label codes

2G: second growth

OG: old growth

80% 2G costs: 2G harvest costs are reduced to 80% of current levels

25% OG prices: prices for 2G logs are set at 25% above minimum price for OG. Note that this is 25% of the range in price for OG logs, e.g., if OG prices vary from $80 to $120, the range is $40, and the price assigned to 2G logs is ($80 + 25% of $40 =) $90.

Proceeding from left to right across the histogram, the first bar represents the value of the resource under current prices and costs – the net revenue is estimated at $-94 million. So, if prices and costs remain the same as are currently experienced, the 4.2 million $m^3$ of second growth that will be available next decade will have a value of $-94 million.

When costs are reduced to 80% of their current level (second bar from left), the value of the resource is still negative ($-24 million). However, if costs remain at their current level and second growth prices rise to low OG levels (third bar), the resource has a positive value of $87 million. The fourth, fifth and sixth bars illustrate the combined effects of a reduction in cost and increase in price.

A cost reduction of 20% equates to 14-20 $/$m^3$ while the price increase to 25% above minimum old growth prices implies a 75 $/$m^3$ increase. Based on experience elsewhere and the likely evolution of the forest sector as described below, we think that these levels of cost reduction and price increase are attainable, and that the majority of the second-growth resource will become economically operable.

### Opportunities to Improve Economic Operability

The three main components of second growth on the islands represent very different opportunities.

Fire-origin stands (4,793 ha) are currently 115-140 years old and well above cutting age. Fire-origin cedar-leading stands with a low proportion of hemlock, are presently economically operable, with the cedar portion carrying the profitability of the stand. The remainder of the stand (hemlock) is fine-grained due to the high density of the fire-origin stands, but prices for hemlock remain low and markets for second-growth hemlock are thin. The increasing capacity and technical capability of drying kilns for hemlock on the coast may improve the marketability of second-growth hemlock.

Fire-origin cedar-leading stands with higher proportions of hemlock are operable only if development costs are low, or if other higher-value stands can carry the operating costs.

A substantial portion (11,393 ha) of the harvest-origin Sitka spruce-leading stands has reached harvesting age (40-60 years) but is currently not economically operable. However, second-growth Sitka spruce is at the beginning of its market cycle and the prerequisite market development activities – identification of technical characteristics and linking of technical qualities to market preferences – appear to be underway. Presently, stumpage fees for Sitka spruce are based on overestimates of its market value and so impede economic operability. If the stumpage issues can be resolved, the fast-growing Sitka spruce-leading stands have the potential to be a valuable resource.

Harvest-origin hemlock-leading stands (9,675 ha) have also reached cutting age (40-60 years) but are currently not economically operable, unless other, higher-value stands can carry the operating costs. Markets for second-growth western-hemlock are well established, but are currently thin and offer low prices. Furthermore, the hemlock stands planted after harvesting are less dense than the fire-origin stands and produce a coarse-grained log. The increasing capacity of drying kilns on the coast may improve the marketability of second-growth hemlock and the industry is actively pursuing the expansion of hemlock markets.

Note that the harvest-origin hemlock-leading stands include Sitka spruce. As the spruce market develops, the spruce portion may end up carrying the profitability of these stands, as does the cedar in fire-origin stands.

The remaining 2261 ha of second growth is predominantly harvest-origin cedar-leading stands. Although no information was obtained on this component during the course of this study, we speculate that its value as cedar will be offset by its coarse grain and the low value of the hemlock portion of the stand. However, it originates from recent harvests and is very young, and will not likely be considered for harvest for 40-60 years.

The economic operability of all components of the second-growth forest will be enhanced by investments in harvesting and milling technology. Mechanized harvesting systems optimized for the second-growth resource will be more cost-effective. Current mill technology is still targeted toward old growth, with larger and more variable log size. Specialized mill technology better able to handle smaller, more uniform second-growth logs, will result in lower costs and greater efficiency. Engineered wood products present a significant opportunity, but require investment in milling and processing capacity.

### Conclusion

Despite the impediments detailed in this report, we are optimistic that the second-growth resource will eventually become economically operable through the normal ongoing processes of market development, technological innovation, and industry investment that are described in this report. The question of the rate at which it will become economically operable is more difficult, and will become crucial as the remaining old growth is harvested or preserved for other societal values

A specific impediment that is easily remedied and has the potential to accelerate the processes leading to economic operability of a substantial component of the second-growth inventory is the high stumpage paid for second-growth Sitka spruce. In general, accommodations in the stumpage system should be developed to accurately reflect current market prices for the second-growth resource on Haida Gwaii.

## Table of Contents

**Acknowledgements** ..... ii

**Executive Summary** ..... iii

**Table of Contents** ..... vii

**List of Figures** ..... viii

**List of Tables** ..... viii

**1.0 Introduction** ..... 1

**2.0 Description of the Second-Growth Resource** ..... 2
- 2.1 Second-Growth Forest Types ..... 2
- 2.3 Productivity of Second-Growth Stands ..... 4
- 2.4 Quality of Second-Growth ..... 5
- 2.5 Location of Second-Growth Stands ..... 7
- 2.6 Comparing Old-Growth and Second–Growth Stands ..... 10

**3.0 Recent Harvesting History** ..... 11
- 3.1 Recent and planned second-growth harvests ..... 11
- 3.2 Minimum harvest ages for second-growth stands ..... 11
- 3.3 Differences between planned and actual harvest ..... 12

**4.0 Harvesting Potential—Short Term** ..... 13
- 4.1 Current Commitment ..... 13
- 4.2 Harvest Costs, Market Price, and Stumpage ..... 13
- 4.3 Market Conditions ..... 15

**5.0 Harvesting Potential—Long Term** ..... 18
- 5.1 Availability of Second-Growth Harvest ..... 18
- 5.2 Revenue from Second-Growth Harvest ..... 18
- 5.3 Mechanized Harvesting Systems ..... 21
- 5.4 Stumpage Issues ..... 21
- 5.5 Alternative Milling Technology ..... 21
- 5.6 Market Development ..... 22
- 5.7 Engineered wood products ..... 23
- 5.8 Silviculture and Second Growth ..... 23

**6.0 Conclusions** ..... 25

**Literature Cited** ..... 27

**Appendix A — Information Request and List of Respondents** ..... 29

**Appendix B — Data Package** ..... 31

**Appendix C — Second-Growth Harvest Potential** ..... 41

**Appendix D — Glossary** ..... 47

## List of Figures


Figure E-1. Components of the second-growth forest of Haida Gwaii/Queen Charlotte Islands. ..... iii

Figure E-2. Value of the existing second-growth resource 10-20 years from now, under various cost and price assumptions. ..... iv

Figure 1. Distribution of the area of the timber harvesting landbase by ageclass, origin and stand growth type. ..... 3

Figure 2. Example of a fire-origin cedar-hemlock stand ..... 4

Figure 3. Example of a harvest-origin Sitka spruce stand – age 45 ..... 4

Figure 4. Sitka spruce core sample from a harvest-origin stand. ..... 6

Figure 5. Relative wood density ..... 7

Figure 6. Distribution of log categories over time for a spruce-leading (SsHw) stand on a medium site. ..... 7

Figure 7. Map of existing old (natural origin) and second-growth (harvest-origin and fire-origin) stands in the timber harvesting land base. ..... 8

Figure 8. Map of second-growth stands (THLB) by site classes. ..... 9

Figure 9. Old-growth versus second-growth spruce: log grades and values. ..... 15

Figure 10. Second-growth spruce and the sales and profit life cycle. ..... 16

Figure 11. Stages of the Competitive cycle and Old-growth Sitka spruce. ..... 17

Figure 12. Potential annual harvest volume (thousands m3) from existing second-growth stands ..... 18

Figure 13. Forecast earliest harvest of second-growth stands, Haida Gwaii/QCI ..... 19

Figure 14. Value of the existing second-growth resource 10-20 years from now, under various cost and price assumptions ..... 20

Figure 15. Components of the second-growth forest of Haida Gwaii/Queen Charlotte Islands. ..... 25


## List of Tables


Table 1. Timber harvesting land base area (ha) by forest-type and origin. ..... 2

Table 2. Components of the second-growth resource on Haida-Gwaii. ..... 3

Table 3. Potential harvest-origin stand volume increases ..... 4

Table 4. Allowable rings for spruce log grades ..... 5

Table 5. Operational differences between old-growth and second-growth stands. ..... 10

Table 6. Historic second-growth harvest levels ($m^3$/year) – all licensees ..... 11

Table 7. Planned second-growth harvest levels ($m^3$/year) – combined for all licensees ..... 11

Table B-1. Forest type definitions. ..... 31

Table B-2. THLB for the second-growth productive forest ..... 32

Table B-3. Grade prices per $m^3$ ..... 32
Table B-4. Managed HwSs Good site yields, grade percentages, and value. ..... 33
Table B-5. Managed HwSs medium site yields, grade percentages, and value. ..... 34
Table B-6. Harvest-origin HwSs poor site yields, grade percentages, and value ..... 35
Table B-7. Harvest-origin SsHw high site yields, grade percentages, and value. ..... 36
Table B-8. Harvest-origin SsHw medium site yields, grade percentages, and value. ..... 37
Table B-9. Harvest-origin SsHw poor site yields, grade percentages, and value. ..... 38
Table B-10. Fire origin Cw medium site yields, grade percentages, and value. ..... 39
Table B-11. Fire origin Cw poor site yields, grade percentages, and value ..... 39
Table B-12. Fire origin HwCw(Ss) medium site yields, grade percentages, and value. ..... 39
Table B-13. Fire origin HwCw(Ss) poor site yields, grade percentages, and value. ..... 39
Table B-14. Minimum harvest age definitions, HG/QCI second-growth analysis ..... 40
Table C-1 Simulated potential harvest volume ($m^3$/decade) for years 2004-2053 ..... 41
Table C-2 Simulated potential harvest area (ha/decade) for years 2004-2053 ..... 44

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## 1.0 Introduction

The Haida Gwaii/Queen Charlotte Islands (HG/QCI) Land Use Planning (LUP) forum is developing a strategic land and resource management plan for the Islands that will include zoning and management direction for a wide range of resource values, including forestry.

In the near future, the majority of the harvest from the Islands will shift to second-growth stands. The extent, value and economic feasibility of harvesting second-growth forests on HG/QCI is contentious. Comparisons of timber quality between old-growth and second-growth forests on the coast of British Columbia indicate that second-growth forests have faster-growing trees with wider growth rings, which can result in lower log grades. These differences need to be understood by the planning table, and considered in the context of the forest industry's experience to date with the harvesting, milling and marketing of second-growth timber.

The objective of this study was to compile information on the value of second-growth timber and establish the location, extent, and economic operability of the second-growth resource for consideration by the HG/QCI Land Use Planning forum. Although environmental concerns regarding the harvest of second growth are a key consideration for the HG/QCI LUP forum, they are outside the scope of this study.

In the first part of this study, we interviewed licensees, log traders and researchers to obtain their advice regarding the marketability, value, *productivity*, *operability*[1], and other economic characteristics of the second-growth resource. A more complete description of the information sought from the operators can be found in Appendix A, together with a list of the respondents.

The second part of this study used the information gathered to modify the forest type classifications, and volume and revenue yield tables of an existing timber supply model – the CIT EGSA Timber model (Williams and Buell, 2004). We used the dataset and model to generate maps and tables of the second-growth resource and determine the volume of logs available at the earliest feasible harvesting age of the second-growth stands. However, this study is not a timber supply analysis – the second growth was not scheduled for harvest in the context of the remaining old growth, and constraints on forest practices (e.g., block adjacency, biodiversity) were not considered.

This report integrates the information obtained from the interviews with the modeling and mapping studies, and discusses the short-term and long-term potential for harvesting the second-growth forest on Haida Gwaii /QCI.

[1] A glossary of technical terms (noted throughout the text in *italics* the first time they are used) is provided in Appendix E

## 2.0 Description of the Second-Growth Resource

For the purposes of this study, we have defined the second-growth forest as harvest-origin stands of age ≤ 60 years, plus stands that regenerated naturally after the Tlell fire.

Second-growth stands—primarily with western hemlock or Sitka spruce as the *leading species*—constitute 39% of the *timber harvesting land base* (THLB) of Haida Gwaii/Queen Charlotte Islands, and may be more productive than assumed in current harvest forecasts.

### 2.1 Second-Growth Forest Types

The interviews with licensees identified 11 forest types—combinations of leading species and *site index* categories—that were correlated to productivity, operability and merchantability. Site index classes reflect the productivity of the stands, and increase from low through poor, medium, and good.

Table 1 lists the site index range and area of forest for each of the forest types in the timber harvesting land base. Low sites, generally not considered operable elsewhere, were included in this analysis because these sites were listed as operable in the Queen Charlotte Islands *Timber Supply Review* (TSR). The TSR found that the *weighted site index* of the low sites was close to the lower limit for the poor productivity sites and hence decided that they were operable.

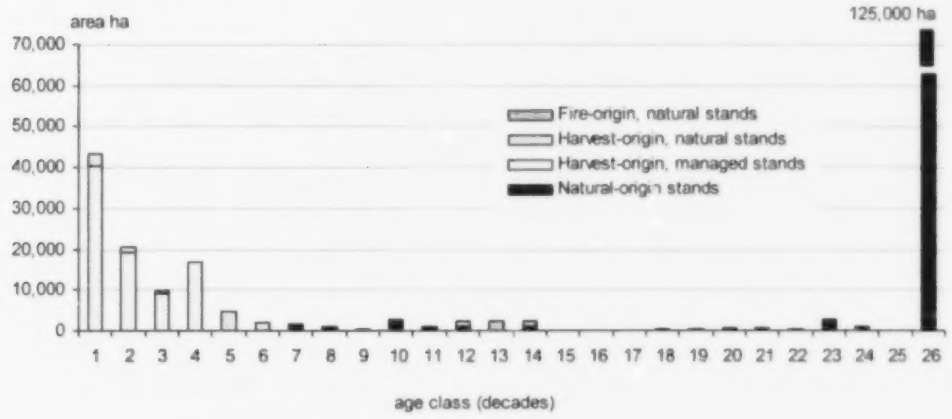
Table 1 also categorizes the operable area of each forest type by stand origin. *Fire origin* stands were differentiated from other second-growth stands based on species, age, and stand characteristics. Fire-origin stands are stands that regenerated naturally following the Tlell fire in the late 1800s and are 115-140 years of age. *Harvest-origin* second-growth stands were planted and/or regenerated naturally following harvesting. Existing natural stands are all stands greater than 60 years of age except the Tlell fire-origin stands. This category constitutes the remaining old forest -- 85% of the operable existing natural stands are older than 250 years. The distribution of the forest by age class, stand origin (harvest, fire, or natural), and stand growth type (managed, natural) is displayed in Figure 1.

**Table 1. Timber harvesting land base area (ha) by forest-type and origin.**

| Forest Types | Site Index | Fire origin (Tlell fire) | Harvest-origin age ≤ 60 years | Existing Natural age > 60 years | Total Area |
|---|---|---|---|---|---|
| Cw_Med | 26 < SI <= 34 | | 35 | 8 | 43 |
| Cw_Poor | 15 < SI <= 26 | 3,844 | 1,507 | 21,231 | 26,583 |
| Cw_Low | SI <= 15 | 949 | 532 | 42,995 | 44,476 |
| HwSs_Good | SI 35+ | | 115 | 18 | 133 |
| HwSs_Med | 26 < SI <= 34 | | 26,167 | 2,973 | 29,140 |
| HwSs_Poor | 15 < SI <= 26 | 174 | 25,441 | 33,937 | 59,552 |
| HwSs_Low | SI <= 15 | 4 | 8,172 | 29,166 | 37,342 |
| SsHw_Good | SI 35+ | | 1,087 | 58 | 1,145 |
| SsHw_Med | 26 < SI <= 34 | | 12,667 | 1,658 | 14,324 |
| SsHw_Poor | 15 < SI <= 26 | 3 | 7,531 | 6,054 | 13,588 |
| SsHw_Low | SI <= 15 | 0 | 5,548 | 6,933 | 12,481 |
| **Total** | | 4,974 | 88,801 | 145,032 | 238,806 |

Forest species composition codes: Hw= western hemlock; Ss=Sitka spruce; Cw= western red cedar.

**Figure 1. Distribution of the area of the timber harvesting landbase by ageclass, origin and stand growth type.**




The age limit for second-growth harvest-origin stands was set at 60 years (decade 6) for this study. An additional 2900 ha of second growth in age classes 7-9, which is classified in Figure 1 as of natural origin, may also be substantially harvest-origin forest. Additional harvest-origin and natural origin stands are available in age classes 10-11, which are also not considered in this study. MSRM estimates that 45% of the timber harvesting land base is comprised of second growth stands of ages < 110 years (John Sunde, pers. comm.).[2]

In the interviews that informed this study, the licensees focused on three aggregations of the second-growth forest types and origins listed in Table 1: fire origin cedar-leading stands, harvest-origin hemlock-leading stands, and harvest-origin spruce-leading stands. We have added a fourth aggregation – harvest-origin cedar-leading stands – to fully account for the second-growth resource. These aggregations of stands are referred to as the components of second growth in the remainder of this report (Table 2).

**Table 2. Components of the second-growth resource on Haida-Gwaii.**

| Component | Area (ha) | Percent of Total Second Growth |
|---|---|---|
| Fire-origin, Cw-leading | 4,793 | 5% |
| Harvest-origin, Hw-leading | 59,892 | 64% |
| Harvest-origin, Ss-leading | 26,832 | 29% |
| Harvest-origin, Cw-leading | 2,256 | 2% |
| Total second growth | 93,775 | 100% |

[2] This estimate was developed from data sources (Gowgaia disturbance updates) that were not available to this study before completion of the data analysis.

Figure 2 is a photograph of a typical fire-established stand. These stands are on gentle terrain and can be harvested with ground-based systems.

Figure 3 is a photograph of a second-growth harvest-origin Sitka spruce stand at age 45. Harvest-origin stands that are Sitka spruce leading typically yield high volumes per hectare.

**Figure 2. Example of a fire-origin cedar-hemlock stand**

**Figure 3. Example of a harvest-origin Sitka spruce stand – age 45**

## 2.3 Productivity of Second-Growth Stands

A recent study (Timberline, 2002a) conducted for Husby Forest Products Ltd. found that harvest-origin stands in the Queen Charlotte *Timber Supply Area* (TSA) are growing two to seven times faster than was assumed in the most recent TSR (Table 3). Sitka spruce, in particular, is a fast growing species on moist, well-drained sites.[3]

**Table 3. Potential harvest-origin stand volume increases**

| | | | | | Actual versus TSR | |
|---|---|---|---|---|---|---|
| Leading Species | Site index (height at age 50) | Actual Volume ($m^3$/ha) | Inventory Volume ($m^3$/ha) | TSR Volume ($m^3$/ha) | Difference in Volume ($m^3$/ha) | Difference Factor |
| Hemlock | 21 - 30 | 72.3 | 28 | 19.6 | 52.7 | 3.7 |
| Hemlock | 31 - 40 | 200.4 | 60.2 | 94.9 | 105.5 | 2.1 |
| Hemlock* | 41 + | 310.6 | 233.9 | 193.9 | 116.7 | 1.6 |
| Spruce | 21 - 30 | 228.6 | 67.2 | 30.3 | 198.3 | 7.5 |
| Spruce* | 31 - 40 | 417.1 | 218 | 85.8 | 331.3 | 4.9 |
| Spruce* | 41 + | 695 | 479.1 | 207 | 488 | 3.4 |

* results should be viewed with caution due to small sample size

Source: Timberline (2002a)

[3] Some licensee's suggest that these high growth rates and yields indicate that *falldown* will not occur on the Islands.

## 2.4 Quality of Second-Growth

The value and marketability of second-growth logs are highly dependent on grain. The more dense the stand, the more slow-growing most of the trees. Slow-growing trees have more narrow growth rings, and therefore are finer-grained. Dense, fire-origin stands yield fine-grained, defect-free cedar and hemlock, but fast-growing harvest-origin stands produce coarse-grained hemlock and Sitka spruce.

Current log grades are determined by grain. The following excerpt from the BC Scaling Manual explains how grain is measured to determine log grade:

> Growth rings are counted at a point 1/3 of the radius in from the logs outer circumference at the small end. The rings are then to be counted in the one rad (2 cm) area from this point towards the outer circumference of the log. (B.C. MOF, 2003).

Note that this method for determining grade depends on the tree's more recent growth rings, and thus the growth conditions it recently experienced. The allowable rings for spruce log grades are listed in Table 4. Coarser-grained logs are of a lower grade, and fetch lower market prices.

**Table 4. Allowable rings for spruce log grades.**

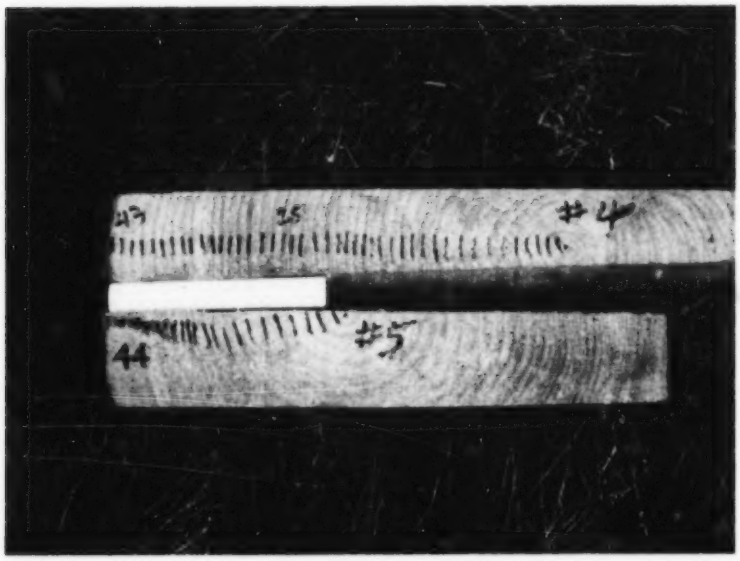
| Spruce Log Grades | Allowable Ring Count |
|---|---|
| "D" | No less than 12 rings per rad |
| "F" No 1 Lumber | 6 rings per rad (2 cm) |
| "G" No 2 Lumber | 6 rings per rad (2 cm) |
| "H" No 2 Sawlog | 5 rings per rad (2 cm) |
| "I" No 3 Sawlog | 4 rings per rad (2 cm) if log is clear, 5 if rough |
| "J" No 4 Sawlog | Less than 4 ring per rad |
| "U, X, and Y" Utility (includes peeler grades) | No restriction |

Note that peeler grades for spruce currently fall under "utility" grades, but can be of higher value than typical of other utility logs.

The two core samples shown in Figure 4 illustrate the coarse grain of harvest-origin Sitka spruce. Sample #4 is from a *dominant* 43-year old Sitka spruce with three rings per rad, and would be graded "J" at best. The second sample (#5) is from a *co-dominant* (and likely slower-growing) tree from the same stand, and would grade higher than the sample #4 log.

There is some anecdotal information about the rate at which grain will improve with age, which is reflected in the difference between grades predicted in *timber cruises* versus grades determined using the scaling measurements described in Table 4. An 80-year-old high productivity site spruce stand was described where the cruised grades were consistent with the scaled grade found in older stands, and the stand subsequently graded out to "H" and "I" sawlogs. In comparison, a 45-year old stand showed a 30% reduction in scaled grade versus cruise grade.

**Figure 4. Sitka spruce core sample from a harvest-origin stand.**

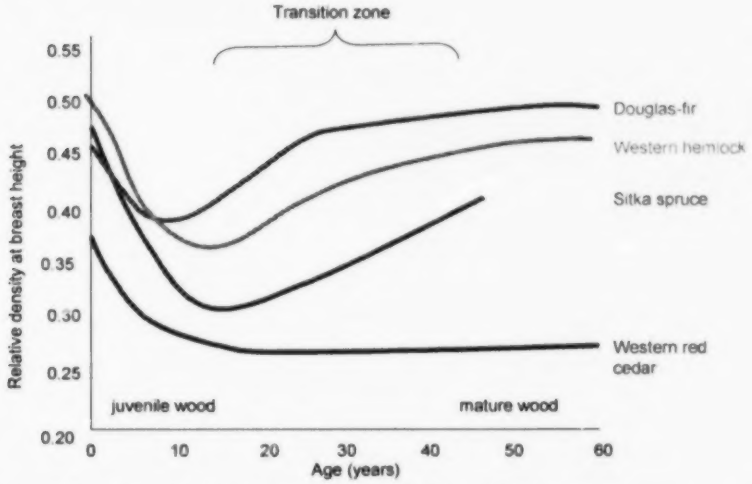



Log buyers indicated that Sitka spruce coming from 80 to 120 year old second-growth stands is still too coarse grained for higher-end log grades. Grain in the 8 to 12 rings per inch range will form in spruce in 80 to 120 stands, but the higher ring counts and finest grained logs will continue to come from old-growth forests. These comments were offered as informed speculation, as no systematic studies are available relating grade to age.

Different tree species typically show different wood densities over time (Figure 5). Sitka spruce experiences a large drop in relative density until it reaches about 45 years old. At this age, its soft wood combined with good form and taper make it conducive to "peeling" and making core veneers. After age 45, relative density begins to increase again towards values more similar to old growth, which on average is about 0.45. At this density, peeler logs yield more valuable surface veneer products.

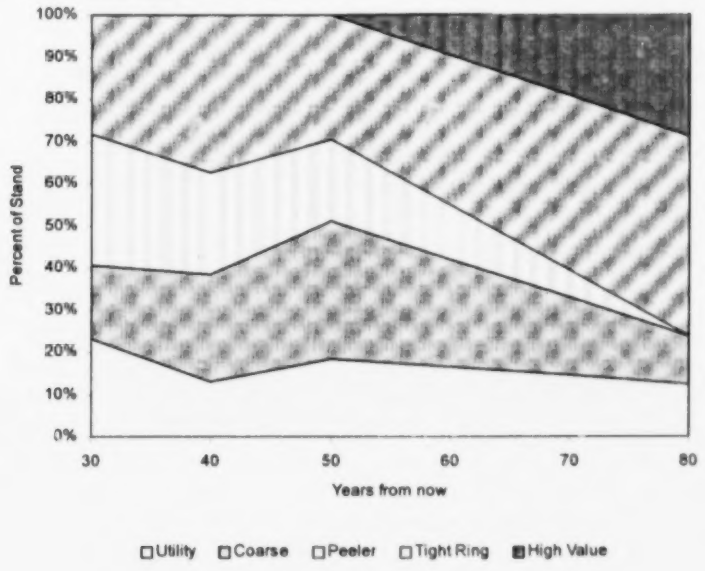
Second-growth stands of different ages have different values partly because their grade composition changes over time. Figure 6 illustrates the development of a medium site spruce-hemlock stand with logs sorted into five categories. (1) utility logs (2) coarse logs with loosely spaced rings (3) peeler logs with more tightly spaced rings and the optimal softness for peeling, (4) sawlogs with more closely spaced rings and (5) high value sawlogs. Sorts 2 through 4 (coarse, peeler and tight ring) are all "J" grade logs.

**Figure 5. Relative wood density.**




Derived from Forintek Special publication No. SP-34, FS74HSP95/3

**Figure 6. Distribution of log categories over time for a spruce-leading (SsHw) stand on a medium site.**




## 2.5 Location of Second-Growth Stands

Figure 7 maps the existing old- and second-growth (harvest-origin and fire-origin) stands in the timber harvesting land base. Figure 8 maps the second-growth stands (THLB) by site class (good, medium, poor, low) and stand origin.

**Figure 7. Map of existing old (natural origin) and second-growth (harvest-origin and fire-origin) stands in the timber harvesting land base.**

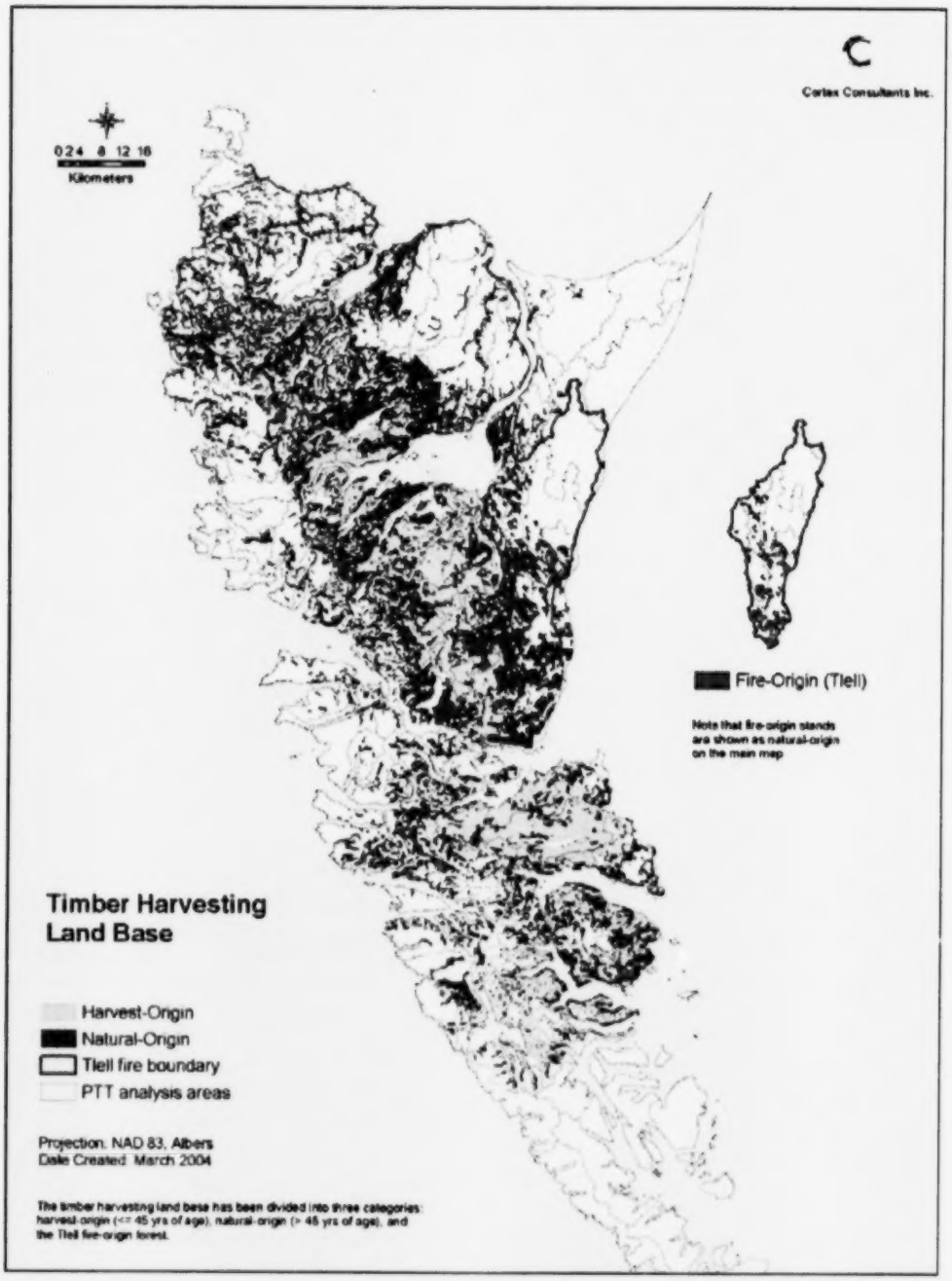
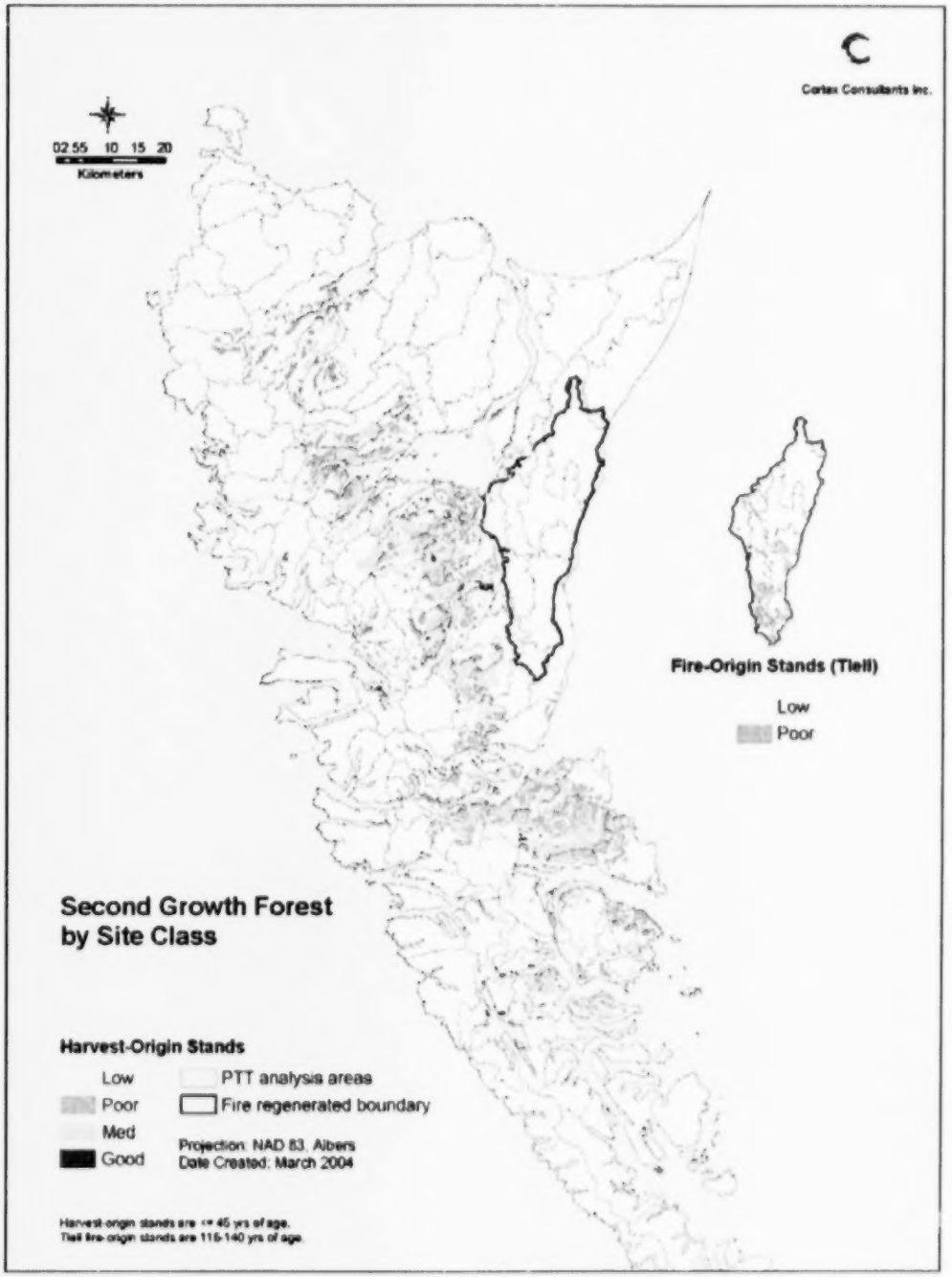

Cortex Consultants Inc.
0 2 4 8 12 16
Kilometers
Fire-Origin (Tlell)
Note that fire-origin stands are shown as natural-origin on the main map
Timber Harvesting Land Base
Harvest-Origin
Natural-Origin
Tlell fire boundary
PTT analysis areas
Projection: NAD 83, Albers
Date Created: March 2004
The timber harvesting land base has been divided into three categories: harvest-origin (<= 45 yrs of age), natural-origin (> 45 yrs of age), and the Tlell fire-origin forest.

**Figure 8. Map of second-growth stands (THLB) by site classes.**



Note that the second-growth stands plotted on Figures 7 and 8 – harvest-origin stands, age ≤ 40-45 years depending on the management unit, plus the Tlell fire-origin stands – are a subset of the total second growth forest defined for this report – harvest-origin stands of age ≤ 60 years, plus stands that regenerated naturally after the Tlell fire. This difference is also present in Figures 12-14, and is due to a shift in project objectives during the course of the study.

## 2.6 Comparing Old-Growth and Second–Growth Stands.

Table 5 compares some operational characteristics of old-growth and second-growth stands.

**Table 5. Operational differences between old-growth and second-growth stands.**

| | Old-growth stands | Second-growth stands |
|---|---|---|
| Density | 500 to 700 m3/ha | Higher; up to 1000 m3/ha |
| Stand value ($/m3) | 100-125 | <70 |
| Riparian operational concerns | Steeper slopes, S5 and S6 classified creeks | Significant hydroriparian areas affect accessibility; ephemeral S4 streams common. |
| Volume/ha cruise estimated versus actual harvested | Under-runs common (i.e. often less volume than was predicted) | Over-runs common (i.e. more volume than was predicted) |
| Decay | Rot defects common | Clean logs, little rot |
| Grain | Tighter grain, with coarse grades 8-12 rings/inch and higher grades up to 32 rings/inch | 4-6 rings per inch |
| Breakage | Requires managing | Little breakage occurs |
| Percent product recovery from harvested logs | Variable | Good |
| Log lengths and piece size | More variable, generally larger piece size | Generally smaller and more uniform |
| Terrain | Steeper | Less steep |
| Harvest systems | Variable: mechanical, grapple, helicopter, cable | Mechanical, ground-based |
| Hemlock | Poor quality | Clean and rot-free |

## 3.0 Recent Harvesting History

Harvesting of second-growth stands has increased from 15 000 $m^3$ per year in the 1990s close to 100,000 $m^3$ in the last few years, and is forecast in *Forest Development Plans* (FDPs) to average 140 000 – 160 000 $m^3$ per year over the next few years.

The majority of this harvest has come from fire-established stands.

### 3.1 Recent and planned second-growth harvests

The historical levels of second-growth harvests are listed in Table 6 and Table 7 contains the planned harvest levels.

**Table 6. Historic second-growth harvest levels ($m^3$/year) – all licensees**

| Year | Harvest-origin Stands | Fire Established Stands |
|---|---|---|
| 2003 | Nil | 89 040 |
| 2002 | Nil | 103 307 |
| 2001 | Nil | 93 812 |
| 2000 | 40 000 | 139 160 |
| 1999 | 12 000 | 59 791 |
| 1992[1] to1998 | Nil | 90 000 |

[1] Source: BCTS and Weyerhaeuser

**Table 7. Planned second-growth harvest levels ($m^3$/year) – combined for all licensees**

| Stand type | Forest Development Plans (FDPs) | TFL Management Plan (MP) and TSR Documents |
|---|---|---|
| Harvest-origin | 40 000 | 60 000<br>Increasing at year 20 |
| Fire Established | 100 000 | ? |

### 3.2 Minimum harvest ages for second-growth stands

Minimum harvest age for second-growth varies with site productivity and stand origin.

The expected minimum harvest age for harvest-origin stands varies among the licensees. Weyerhaeuser (MWP 8) specifies 70 years as the expected average age of harvest in their management plan. Western Forest Products (MP 10, Oct 2003) specifies 93-98 years for second growth, and that harvest-origin stands will attain 47/42/36 cm (quadratic) mean *diameter at breast height* (dbh) on good, medium and poor sites, respectively, at age 70. On high productivity sites,

Teal-Jones Group (TFL 47) plans to harvest harvest-origin second growth at age 40. BC Timber Sales (BCTS) and Husby Forest Products currently follow TSR assumptions that harvest-origin second-growth harvests will occur for hemlock and spruce-leading stands at ages 80 through 130. Interviews with licensees suggest that the higher harvest age assumptions (>70 years) may be conservative, to the extent that trees can already be too large for optimal mechanical harvesting by stand age 50-60.

The licensees with access to the fire-established stands (Weyerhauser and BCTS) expect to enter fire-established stands at the same age - age class 7 or 120 years - due to denser, medium to lower productivity stands requiring more time to reach harvestable piece size. In fire-established stands, cedar-leading stands are preferred for harvesting as the cedar component of the stand carries a higher value than the minor component (usually hemlock). The stand becomes economically operable when the minor component becomes profitable. However, current hemlock prices are too low to allow the harvest of many of these stands. BCTS indicated that several of their FDP blocks were in this position – deferred from harvesting until the hemlock component increases in value sufficiently that the whole stand can be harvested profitably.

### 3.3 Differences between planned and actual harvest

Deviation of the actual harvest from the planned harvest of second-growth stands in the QCI TSA differs according to stand origin. Fire-origin stands, because of their significant and valuable cedar component, are normally harvested according to plan. The timing of the harvest of harvest-origin stands depends mostly on market prices reaching an economically viable threshold for the species, grade and volume profile of the stand.

## 4.0 Harvesting Potential—Short Term

In the short term – the next 20 years – the industry is scheduled to become increasingly dependent on the second-growth resource, but current economic and market constraints must be overcome.

### 4.1 Current Commitment

The transition from harvesting old-growth timber to the harvesting of second-growth is well underway. Harvest projections for the *Tree Farm Licenses* (TFLs) remain dependent on old-growth currently, but become increasingly dependent on second-growth over the next 20 years.

- TFL 39 forecasts that 50% of its annual harvest will be taken from second-growth by about 2040.
- TFL 25 Block 6 plans to begin the transition to second-growth in 2015 and complete in 2042.
- TFL 47 will become entirely dependent on second-growth over the next 20 years.

The most recent timber supply analysis for the QCI TSA predicts that the harvest will rely primarily on fire-established second-growth stands in the short to mid term – BCTS projects 27% of their harvest to be from second-growth over the next five years. Harvest-origin second-growth stands are forecast to enter the harvest by the end of the current 20-year plan.

### 4.2 Harvest Costs, Market Price, and Stumpage

As described section 2, the physical extent of the second-growth resource is substantial, and the licensees report that the fire-established stands are presently economically viable. However, development of the harvest-origin stands – both Sitka spruce leading and hemlock leading – is limited by economic considerations.

Harvesting costs for second-growth were not reported by the licensees, as they consider this information to be proprietary. However, simulated appraised costs (harvesting costs excluding *stumpage* fees) forecast in a recent study (Timberline, 2002b) range from $70-90 per $m^3$ for harvest-origin stands and $110-120 per $m^3$ for fire-origin stands. These costs are calculated at the minimum harvest ages that were supplied to this study by the licensees.

Both fire-origin and harvest-origin stands contain significant hemlock components, and in each case, the hemlock volume is the lower-value component. Second-growth hemlock is currently of low market value and stands with a high proportion of hemlock generally are not economically viable. Decisions regarding whether to harvest these stands are based on the costs of development combined with the proportion of hemlock. If hemlock makes up a large proportion of the stand but development cost are low, the stands may be harvested. If development is expensive, the stand will not be logged.

Fire-origin stands sell into markets with prices of $45 - $50/$m^3$ for hemlock and spruce, and $75 to $105 per $m^3$ for cedar. These stands tend to have a high component of clear, defect-free cedar, and spruce volumes are minor (generally less than 5%). The profitability of the stand is determined by the high-value cedar component.

Harvest-origin stands, with significant hemlock and Sitka spruce volume, receive $50 to $55 per $m^3$ and typically net the operator a negative $10 to $20 per $m^3$ after operating costs and stumpage. Licensees (QCI TSA) reported that stand values (harvest-origin) of $75 per $m^3$ would allow them to break even after stumpage and operating costs.

Under current market conditions, hemlock-leading second-growth stands are generally not profitable to harvest, unless the development costs can be largely covered by other more valuable stands.

However, if spruce prices increase, second-growth stands with high proportions of spruce and minor components of hemlock will become economically viable, and if the price is high enough, the spruce components will carry the profitability of hemlock-leading second-growth stands. The remainder of the discussion below therefore focuses on the spruce component of harvest-origin stands.

Stand value in harvest-origin stands is correlated to the age and the proportion of the Sitka spruce component. However, stand value does not increase with age in a linear fashion.

Younger, fast-growing stands contain a *peeler* component of relatively valuable spruce logs, but as the stand age approaches 50 years, the proportion of peeler grade logs falls, and the stand's value is then mainly determined by the higher proportion of coarse-grain sawlog grades of lower value. The stand value eventually increases again as grains become tighter in older stands, and although at what age this occurs depends on site density and productivity. Timber planners interviewed as part of this study speculated that higher site productivity harvest-origin stands may still be producing coarse grain timber at age 80.

A denser stand with smaller stems may achieve a higher value, due to having a tighter grain and higher grades, than a wide-spaced stand of the same site and age.

This unusual value time-path—with average grade value higher when spruce is young peeler grade, then lower as it grows into coarse-grain sawlogs, and then subsequently recovering as the grain becomes tighter—is not captured by the current stumpage system. The licensees argue that the *Market Price System* (MPS) significantly overestimates the market value of harvest-origin stands on HG/QCI. Under MPS, the stand value is based on cruised grades that are assessed based on diameter and form, whereas sold value is highly dependent on grain.

Large trees are cruise graded as H and I sawlogs, but scale records indicate that most of those logs are subsequently downgraded to J because of coarse grain. Furthermore, the market price assumed for J grades is based on the tight grain J grade logs associated with sawlogs from older stands that still predominate in the market. Second-growth sawlogs will have even wider spaced growth rings than those graded 'J' that come from older forests that developed from natural-origin, high density stands.

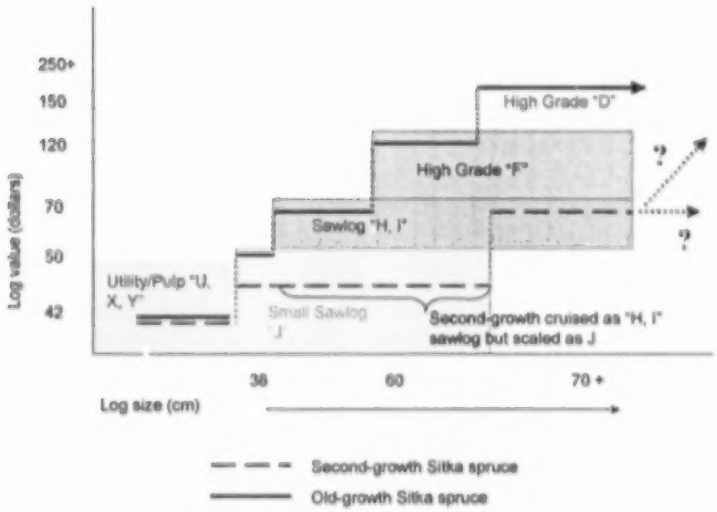
Figure 9 illustrates the differences in grade and value for similar-sized logs coming from second-growth versus old-growth spruce stands. As second-growth spruce logs increases in size, their grade and value increase much more slowly than do the grade and value of old-growth spruce logs of the same size. Cruise appraisals do not adequately reflect this difference.[4] The size and age at which second-growth spruce attains the high grade are unknown. Scales are approximate and for illustration only.

[4] BC MOF Revenue Branch does account for second-growth spruce H and I grades but the licensees contend that the values are not representative due to the low volume of transactions.

Other factors inherent in the MPS system increase stumpage charges for the second-growth coarse-grained Sitka spruce stands:

- higher volumes per hectare than old-growth stands, which are assumed to result in a higher financial return per area harvested
- higher volumes per hectare are assumed to result in more bidders being attracted to the sale, and therefore *upset stumpage* will also be higher
- gentler terrain (less side-slope) than the remaining old-growth stands means harvesting costs are assumed to be lower and stumpage is therefore set higher.

**Figure 9. Old-growth versus second-growth spruce: log grades and values.**




Although the MPS system is designed to be market sensitive, *BC Timber Sales* (BCTS) on the Islands is not proposing any auction sales in harvest-origin second-growth stands within the term of the current HG/QCI Forest Development Plans (FDPs), although this may change with TFL takebacks. Because it is BC Timber sales auctions that help establish accurate, market-based stumpage rates, if there are no BCTS sales in HG/QCI harvest-origin second-growth stands, the MPS system will likely remain out of sync with any developing second-growth market in harvest-origin stands in the QC TSA.

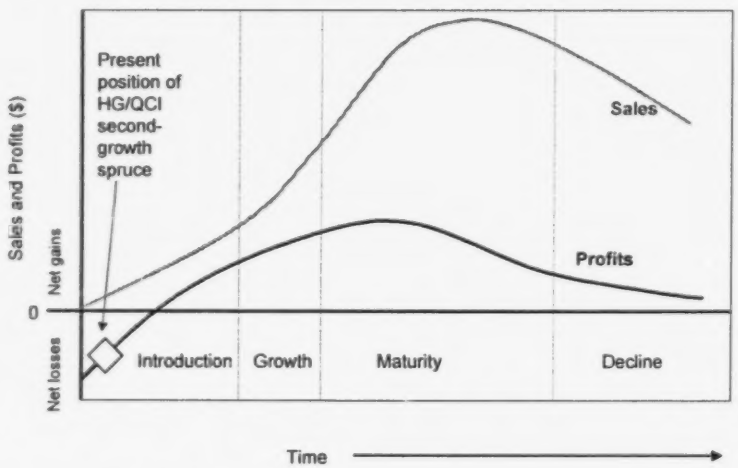
### 4.3 Market Conditions

The market for cedar and hemlock is well established and will absorb any volume of fire-origin fine-grained logs. Conversely, second-growth Sitka spruce logs from harvest-origin stands have a limited market. Discussions with log traders and licensees indicate that the Vancouver Log Market can absorb a maximum of 2 000 $m^3$ per delivery.

Harvest-origin second-growth spruce is at the introductory stage of its market cycle (see Figure 10). Typically when a product first enters markets, net revenue is negative and market share is small. Net revenue gradually increases and market share grows but eventually decreases again as the market for the product moves through maturity into decline.

The lack of market capacity for second-growth Sitka spruce can be attributed to several factors. Second-growth Sitka spruce is a new market entrant with different technical characteristics than old-growth Sitka spruce, and it has received very little direct marketing effort. Delivered volumes have been mostly incidental and sold wherever a market opportunity could be found, depending on the international market of the day.[5] In addition, there is a lack of incentive to develop a second-growth market resulting from barriers to export, US tariffs, and the discouraging capital investment climate of the entire B.C. coast, including Haida Gwaii/Queen Charlotte Islands.

**Figure 10. Second-growth spruce and the sales and profit life cycle.**




Adapted from Kotler and Armstrong (2002).

Meanwhile, the market for old-growth Sitka spruce has eroded over the last decade. Markets have fallen in response to the high prices and decreasing availability of logs due to depletion of the resource, harvesting regulations and land use decisions. Log traders interviewed in the course of this study stated that old-growth spruce is contracting to a small specialty-market niche (Figure 11). Typically, once a timber type drops below a threshold in supply, there is too little wood to supply mills, lumber buyers stop recognizing and purchasing the timber type, and the market eventually disappears. At the same time, the original product is replaced by substitutes (in this case, engineered wood products and other timber types).

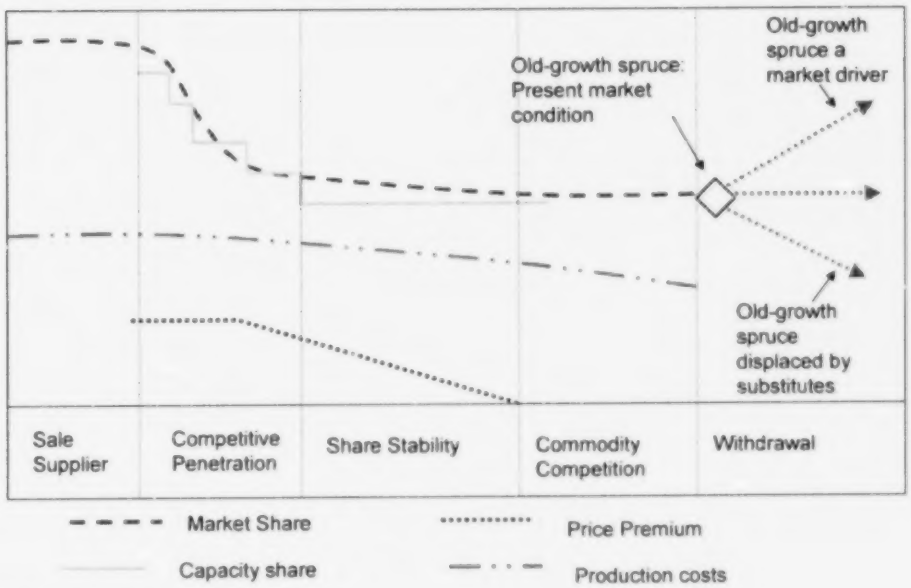
Globally, markets and technology have been evolving away from old-growth harvesting, toward second-growth harvesting and engineered wood products. Substitution of engineered wood

[5] International market conditions include the availability of export permits and US lumber prices.

products has encroached on the market for solid wood from British Columbia. For example, spruce beams and timbers once used in Japanese houses are now replaced with a composite wood product faced with a veneer that makes the beam look like it is clear wood.

It is quite possible that old-growth spruce will not be economically viable into the future. However, it is also possible that the forest industry will re-establish spruce as a market driver by securing the necessary timber supply and placing the product in new or re-established market segments.

**Figure 11. Stages of the Competitive cycle and Old-growth Sitka spruce.**




Adapted from Kotler and Armstrong (2002).

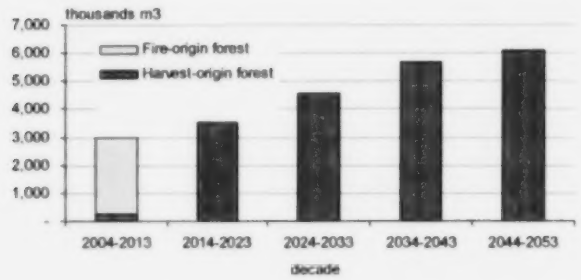
## 5.0 Harvesting Potential—Long Term

In the long term, the economic and market constraints described in section 4.0 will be addressed by reducing harvesting costs, resolving stumpage inequities, implementing appropriate milling technology, and developing products and markets for second-growth logs.

### 5.1 Availability of Second-Growth Harvest

We simulated the harvest of the existing second-growth by scheduling stands for cutting at their minimum harvest ages.[6] Figure 12 shows the volume potentially available from this schedule. The schedule reflects the stands' earliest theoretical harvest date without consideration of remaining old-growth volumes and does not consider TSR harvest flow rules or constraints on forest practices.[7] Figure 13 maps the second-growth stands that are available for harvest over the next 50 years.

**Figure 12. Potential annual harvest volume (thousands m3) from existing second-growth stands.**




All assumptions used for this study (including yield tables, grade tables, prices, and values) are documented in the Data Package prepared for this project and included in this report as Appendix B. For further information on the model itself, see Williams and Buell (2004). Several tables of data have been generated which summarize the harvest area and volume from harvesting second-growth stands. These values have been summarized by reporting units and can be found in Appendix C. [8]

### 5.2 Revenue from Second-Growth Harvest

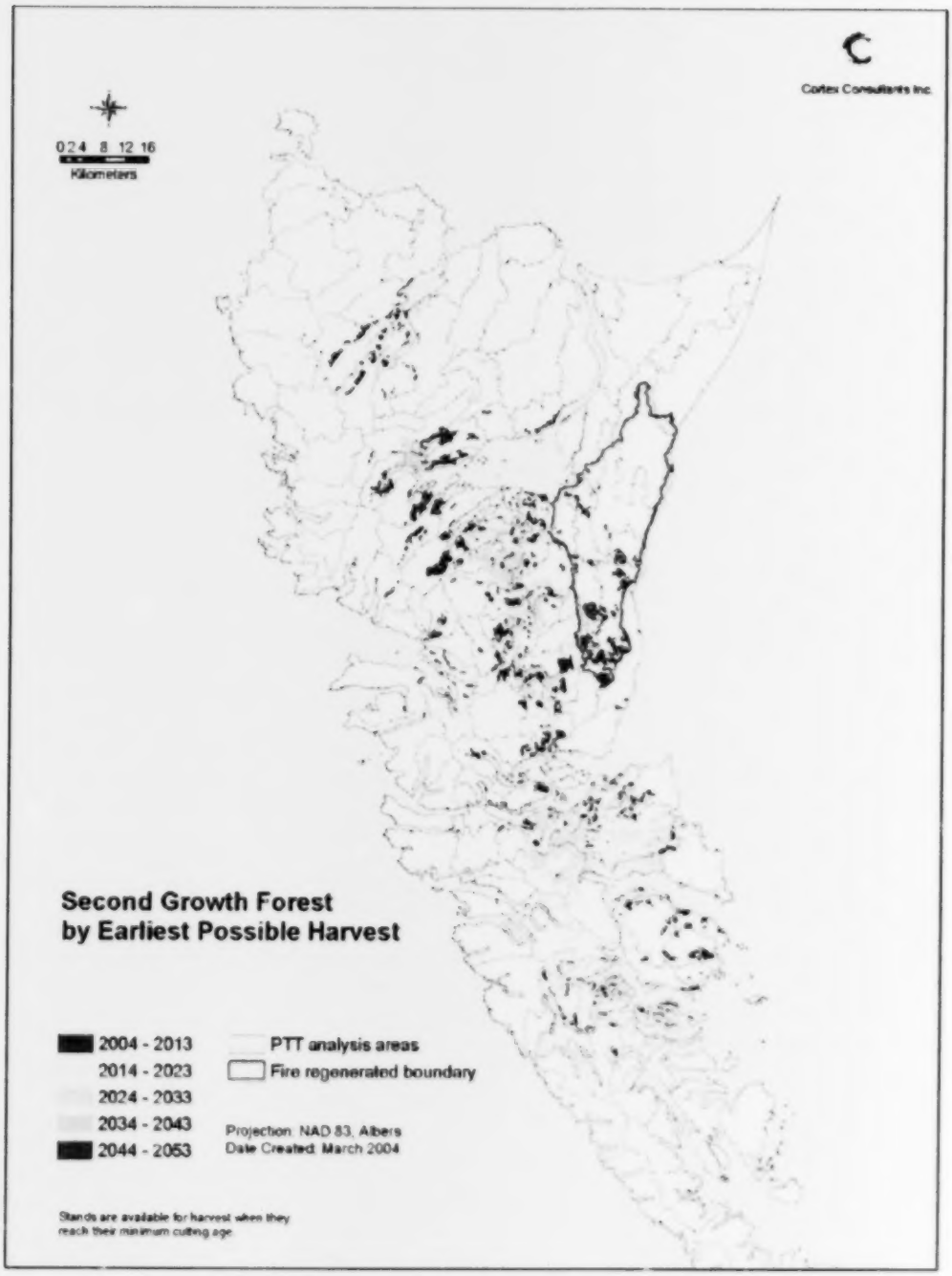
Figure 12 illustrates the schedule of availability of the second-growth resource, but says nothing about its profitability. To explore this issue we estimated the value of the second-growth resource over the next 10-20 years (2014 -2023 in Figure 12) under a variety of price and cost assumptions. The value of the resource was calculated as its net revenue—the market value for logs minus the

[6] Minimum harvest ages by forest type are listed in Appendix C, Table C-14.

[7] Timber Supply Review (TSR) flow rules limit the rate at which the forecast harvest level changes from decade to decade

[8] The HG/LUP Process Technical Team (PTT) has defined 145 land units (reporting units) covering the plan area.

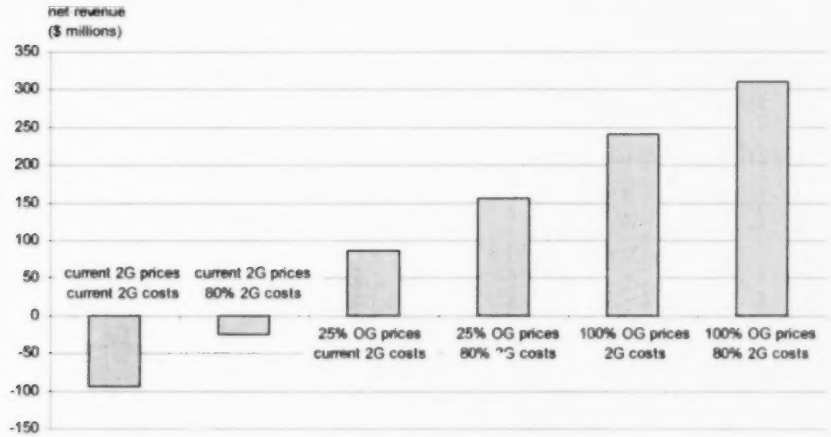
**Figure 13. Forecast earliest harvest of second-growth stands, Haida Gwaii/QCI.**



costs of their harvesting and transportation. The harvest costs used here are essentially simulated appraisal costs determined in the woodshed study recently conducted for Haida Gwaii (Timberline, 2002b).

Note that appraisal costs, especially as applied in the woodshed studies, are broad averages of costs experienced by licensees and do not accurately represent any specific situation. However, we find that the modeled costs are useful for examining the "big picture" about the value of the second-growth resource. The results of this analysis are presented in Figure 14.

**Figure 14. Value of the existing second-growth resource 10-20 years from now, under various cost and price assumptions.**




Explanation of label codes

2G: second growth

OG: old growth

80% 2G costs: 2G harvest costs are reduced to 80% of current levels

25% OG prices: prices for 2G logs are set at 25% above minimum price for OG. Note that this is 25% of the range in price for OG logs, e.g., if OG prices vary from $80 to $120, the range is $40, and the price assigned to 2G logs is ($80 + 25% of $40 =) $90.

Proceeding from left to right across the histogram, the first bar represents the value of the resource under current prices and costs – the net revenue is estimated at $-94 million. So, if prices and costs remain the same as are currently experienced, the 4.2 million $m^3$ of second growth that will be available next decade will have a value of $-94 million.

When costs are reduced to 80% of their current level (second bar from left), the value of the resource is still negative ($-24 million). However, if costs remain at their current level and second growth prices rise to low OG levels (third bar), the resource has a positive value of $87 million. The fourth, fifth and sixth bars illustrate the combined effects of a reduction in cost and increase in price.

A cost reduction of 20% equates to 14-20 $/$m^3$ while the price increase to 25% above minimum old growth prices implies a 75 $/$m^3$ increase. Based on experience elsewhere and the likely evolution of the forest sector as described below (sections 5.3-5.8), we think that these levels of

cost reduction and price increase are attainable, and that the majority of the second-growth resource will become economically operable.

### 5.3 Mechanized Harvesting Systems

Mechanized harvesting systems are required that are efficient for second-growth stands and will produce logs that are of appropriate dimension for small-log mills and market-demanded products. Mechanized systems offer numerous advantages. They are:

- efficient in stands with small stems and an even distribution of log diameters
- efficient over a variety of harvesting and silvicultural systems, including variable retention strategies
- cost effective
- capable of producing a high quality log
- maneuverable and flexible around resource features and retention zones

Mechanized harvesting equipment geared for second-growth (feller/processors, log forwarders, loading and truck systems) will require substantial investment and significant volume to justify the cost. The small volumes of second-growth that are currently harvested are inadequate to compensate for the costs of mechanized harvesting, and blending a small amount of second-growth harvesting into an existing harvest program can be as disruptive as it is beneficial. For example, to bring in a processor for a short period of time and harvest only a small volume of second-growth timber and then move it out again inflates costs, and although off-highway trucks can haul second-growth, the method for off-loading timber has to be modified to reduce breakage.

### 5.4 Stumpage Issues

All respondents interviewed have listed current stumpage rates as a significant barrier to the utilization of second-growth stands of Sitka spruce, with the appraised price being too high to allow for financially viable harvesting.

The upward bias in appraised price induced by cruise grades and lack of recognition of the lower market value for coarse grain second-growth was described in section 4.2. Furthermore, second-growth Sitka spruce has generally been delivered as a minor component of a hemlock shipment, with the consequence that Vancouver Log Market prices for Sitka spruce are similar to those of hemlock.

The Coastal Appraisal System has evolved to fairly account for second-growth Douglas-fir and western hemlock, and the same requirement now exists for Sitka spruce. Some respondents suggested that second-growth Sitka spruce stands require a separate grade. Another approach suggested is to encourage BCTS to market a selection of second-growth stands in order to establish comparative-sale values.

### 5.5 Alternative Milling Technology

One of the constraints on the market's acceptance of second-growth Sitka spruce is that the milling technology is geared to old-growth logs and the output of higher-valued products.

Traditional coastal sawmills employ a *head-rig* designed to handle the large and varied log shapes and be able to cut to the market demand for multiple products. A mill dedicated to second-growth spruce would replicate the type of specialized sawmill that is common in BC's interior, where logs are within a smaller size range and the product is less varied, and has been implemented more recently on the coast to process second-growth hemlock and Douglas-fir.

Harvesting of second-growth Douglas-fir and hemlock on the southern coast has developed rapidly in recent years. Small-log processing mills have been developed – the TimberWest mill at Elk Falls recently completed upgrades for small-log systems, and Teal-Jones recently installed a new small-log line in their Surrey mill.

This type of specialized mill typically experiences processing costs reductions of 25-35%. Given the large size of second-growth Sitka spruce logs, "small-log" mills for spruce will likely be designed for significantly larger logs than the current coastal small-log mills. As mills gain efficiency with increasing log size, small-log mills optimized for Sitka spruce can expect to achieve even greater cost reduction.

Along with small-log mills, another capital investment that will enhance the marketability of second-growth hemlock is drying kilns. Pearse (2001) describes in some detail the rejection of green (not kiln-dried) lumber by Japan following the Kobe earthquake of 1995 and the inadequate hemlock drying capacity on the BC coast. However, in recent years technical impediments to kiln-drying hemlock have been overcome, and cost-effective technology has been implemented – several new kilns have been installed on the BC Coast. BC is regaining market share in Japan and 70-75% of hemlock exported to Japan is targeted to be kiln-dried within the next five years. The remainder of the hemlock exported to Japan will remain green, for sale to the Japanese wood-preserving industry. This industry makes use of hemlock's exceptional ability to absorb wood preserving treatments, which are legally required for wood used in certain parts of Japanese structures. (Brian Zak, pers. comm.). [9]

### 5.6 Market Development

Some licensees and log traders interviewed suggested that HG/QCI second-growth markets will develop in a manner similar to second-growth Douglas-fir markets. Ten years ago, 90% of the Douglas-fir logs sold were old growth – today 90% of Douglas-fir sold is second-growth.

The second-growth Douglas-fir market was first established in the US Pacific Northwest, and British Columbia has followed suit in developing appropriate milling technology and pursuing a market share. Pacific Rim markets have accepted coarse-grain second-growth Douglas-fir, and production has increased to meet the expanding demand.

Part of the success in gaining market acceptance of second-growth Douglas-fir was the identification of its technical characteristics. In the early 1980s, Forintek studies clarified the strength characteristics of second-growth Douglas-fir and recommended machine-stress rating over the visual grading rules current at the time. (Les Jozsa; pers. comm.).[10]

The market for second-growth Sitka spruce is in an early stage of development. Presently companies on the Olympic Peninsula export coarse-grained Sitka spruce to northern Japanese

[9] Brian Zak, Chief Operating Officer, Coast Forest and Lumber Association, interviewed by Audrey Roburn, June 3 and 6, 2004.

[10] Les Jozsa, Research Scientist Emeritus, Forintek Canada Corp., interviewed by Audrey Roburn, June 1 2004.

markets. B.C. second-growth spruce volumes and market prices have been too low to motivate any significant market development. To date, BC second-growth spruce volumes have been blended into shipments destined for US markets and into offshore export packages.

However, Jozsa contends that the density of second-growth Sitka-spruce is adequate, and that even widely-spaced or pruned second-growth spruce is of adequate density; if proper grading is developed, quality issues should not hinder the market acceptance of second-growth Sitka-spruce.

The Coast Forest and Lumber Association (CFLA) is currently working with the University of British Columbia, Forintek, and Japanese research agencies to study the technical properties of second-growth Sitka-spruce (and other coastal species). To counter its lack of acceptance in the dimension marketplace, CFLA is working to reposition second-growth Sitka-spruce by showing its higher-strength values in order to get a higher return.

Zak also stresses that focusing on the particular technical characteristics of the species is important when developing a market. In Japan, the CFLA promotes the high density, high strength, high nail-holding strength and low deflection properties of hemlock—properties that are especially desirable in earthquake-prone Japan. Note that these qualities can be common to both old-growth and second-growth hemlock as the two will often have similar density characteristics.

In addition to the focused efforts by the industry associations and research agencies, the licensees on Haida Gwaii are individually identifying markets and establishing trials for second-growth fibre, through their current system of log brokers and buyers.

### 5.7 Engineered wood products

As noted in section 4.3, engineered wood products have taken an increasing share of the market. Currently no engineered Sitka spruce is produced in BC. However, the high strength-to-weight ratio may attract the development of engineered products. One of the key advantages of engineered wood products is that they utilize low-grade, small diameter logs to manufacture a high-grade product. Processing makes better use of small diameter trees (80%) than traditional sawmilling (40%).

Other jurisdictions are currently exploring the potential for engineered Sitka spruce products. For example, Southeast Alaska has identified a market in Japan for laminated timber stock, and is proposing to use Sitka spruce to supply this growing market. Irish researchers are investigating the development of a sawn products industry based on Sitka spruce stands planted after World War II. (Note: this section draws heavily on Braden et al. (n.d.).)

### 5.8 Silviculture and Second Growth

As described in section 2.4, the market value of second-growth stands is currently tied to high stand density through grain quality. Planting Sitka spruce on appropriate sites establishes a fast growing stand, but currently its market acceptance is limited by coarse grain.

A silviculture strategy prepared for TFL 39 (Olivotto Timber Ltd., 2001) recommends fertilization of poor site cedar/hemlock stands at establishment, and forecasts that a treated stand would reach maturity 20 years in advance of an untreated stand, with diameter and volume developing at the same accelerated rate. A silviculture strategy prepared for the Queen Charlotte TSA

(Forest Ecosystem Solutions Ltd., 2001) recommended a program focused on spacing and pruning good site hemlock and spruce, with the objective of increasing log diameter and the volume of clear wood.

Studies conducted by Forintek support this pruning strategy. Jozsa et al. (1993) found that – excluding the first 20 years of rings – wood from rapidly grown second-growth spruce was of sufficient ring density to meet the standards of top grades. The study noted that, if the sample trees were pruned at a young age, the outermost (post 20 years) clear wood would make top grades.

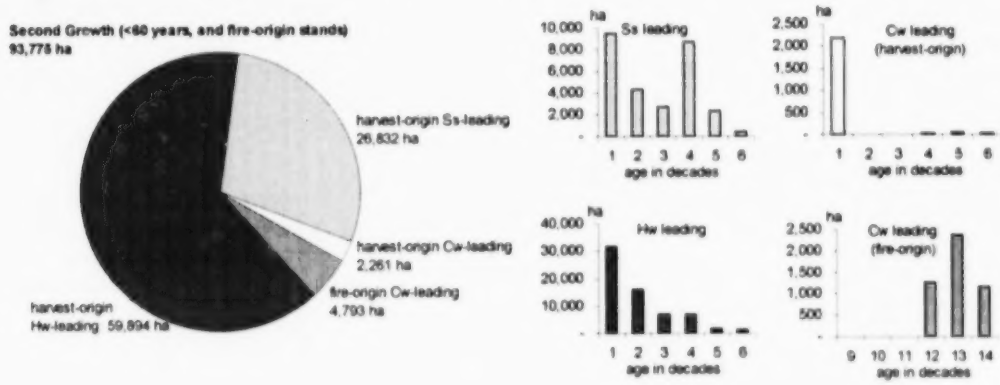
To the extent that the current market favours tight-grained logs, spacing treatment regimes may have negative economic consequences, especially for Sitka spruce. However, future markets may develop which are less focused on grain (see comments by Jozsa, section 5.6) and will reward the faster growing poor site cedar/hemlock and larger dimension clear logs.

## 6.0 Conclusions

Second growth is an emerging opportunity for the timber harvesting industry and forestry-dependent communities on Haida Gwaii/Queen Charlotte Islands. Stand volumes are much higher than originally predicted, and a large resource is accumulating. However, some challenges must be overcome in order to fully realize the potential of second-growth.

Three main components of second growth on the islands – harvest-origin hemlock-leading, harvest-origin spruce-leading, and fire-origin cedar-leading stands (Figure 15) – represent very different opportunities. The fourth component – mainly harvest-origin cedar-leading stands – originates from recent harvests and was not discussed in the interviews that informed this study.

**Figure 15. Components of the second-growth forest of Haida Gwaii/Queen Charlotte Islands.**




Fire-origin stands (4,793 ha) are currently 115-140 years old and well above cutting age. Fire-origin cedar-leading stands with a low proportion of hemlock, are presently economically operable, with the cedar portion carrying the profitability of the stand. The remainder of the stand (hemlock) is fine-grained due to the high density of the fire-origin stands, but prices for hemlock remain low and markets for second-growth hemlock are thin. The increasing capacity and technical capability of drying kilns for hemlock on the coast may improve the marketability of second-growth hemlock.

Fire-origin cedar-leading stands with higher proportions of hemlock are operable only if development costs are low, or if other higher-value stands can carry the operating costs.

A substantial portion (11,393 ha) of the harvest-origin Sitka spruce-leading stands has reached harvesting age (40-60 years) but is currently not economically operable. However, second-growth Sitka spruce is at the beginning of its market cycle and the prerequisite market development activities appear to be underway -- identification of technical characteristics and linking of technical qualities to market preferences. Presently, stumpage fees for Sitka spruce are based on overestimates of its market value and so impede economic operability. If the stumpage issues can be resolved, the fast-growing Sitka spruce-leading stands have the potential to be a valuable resource.

Harvest-origin hemlock-leading stands (9,675 ha) have also reached cutting age (40-60 years) but are currently not economically operable, unless other, higher-value stands can carry the operating costs. Markets for second-growth western-hemlock are well established, but are currently thin and of low value. Furthermore, the hemlock stands planted after harvesting are less dense than the fire-origin stands and produce a coarse-grained log. As already noted, the increasing capacity of drying kilns on the coast may improve the marketability of second-growth hemlock and the industry is actively pursuing the expansion of hemlock markets.

Note that the harvest-origin hemlock-leading stands include Sitka spruce. As the spruce market develops, the spruce portion may end up carrying the profitability of the stands, as does the cedar in fire-origin stands.

The remaining 2261 ha of second growth is predominantly harvest-origin cedar-leading stands. Although no information was obtained on this component during the course of this study, we speculate that its value as cedar will be offset by its coarse grain and the low value of the hemlock portion of the stand. However, it originates from recent harvests and is very young, and will not likely be considered for harvest for 40-60 years.

The economic operability of all components of the second-growth forest will be enhanced by investments in harvesting and milling technology. Mechanized harvesting systems optimized for the second-growth resource will be more cost-effective. Current mill technology is still targeted toward old-growth, with larger and more variable log size. Specialized mill technology better able to handle smaller, more uniform second-growth logs, will result in lower costs and greater efficiency. Engineered wood products present a significant opportunity, but require investment in milling and processing capacity.

Despite the impediments detailed in this report, we are optimistic that the second-growth resource will eventually become economically operable through normal ongoing processes of market development, technological innovation, and industry investment. The question of the rate at which it will become economically operable is more difficult, and will become crucial as the remaining old growth is harvested or preserved for other societal values.

A specific impediment that is easily remedied and has the potential to accelerate the processes leading to economic operability of a substantial component of the second-growth inventory is the high stumpage paid for second-growth Sitka spruce. In general, accommodations in the stumpage system should be developed to accurately reflect current market prices for the second-growth resource on Haida Gwaii.

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## Appendix A — Information Request and List of Respondents

March 4, 2004

**To: Bob Brash, RPF, Husby Forest Products Ltd.**
**cc: Licensees and Operations, Haida Gwaii / QCI**

Dear Mr. Brash,

**Re: Second-growth Timber Opportunities on Haida Gwaii / QCI**

HiMark Forest Consultants Ltd. and Cortex Consultants Inc. have been retained by the Ministry of Sustainable Resource Management (MSRM) to assemble second-growth valuation information for the Land Use Plan (LUP) Table currently in progress for Haida Gwaii / QCI. We are seeking advice and data (where available) from the licensees on the following issues:

- Growth and yield (G&Y) data relevant to second-growth stands
- Operability criteria for second-growth
- Harvesting activity:
    - Historic and current second-growth harvest
    - Planned second-growth growth harvest
- Reasons why planned, actual, and forecast harvest levels may differ
- Second-growth log values, both present and future
- Estimates as to the profitability of existing second-growth
- Challenges and opportunities associated with profitable second-growth harvesting
- Expected differences between old-growth and second-growth logs in lumber recovery, quality, and markets

HiMark will be contacting licensees to arrange for interviews. The LUP Table requires realistic operational information on second-growth timber to allow the evaluation of alternative planning scenarios. However, HiMark (and MSRM) is sensitive to the strategic nature of much of this information and will respect confidentialities and restrictions on the use of data if requested by a licensee.

Please distribute this primer to participating licensees. The project will be delivered March 26, 2004 and interviews must take place over the next two weeks.

Yours truly,

John Cookman, RPF
HiMark Forest Consultants Ltd

Personal interviews were conducted with the following individuals:

Teal-Jones Group

- Dale Morgan, Forester
- Brad Tanner, Planner
- Warren Stoughton, Engineer
- John Houston, Scaler
- Paul Leslie, Failer

Weyerhaeuser Company Ltd.

- Dave Trim, Planner
- Hyland Fraser, Engineer

BC Timber Sales

- Rick Johnson
- Paul Barolet

Husby Forest Products Ltd.

- Bob Brash
- Rob Comolos (lumber trader) on speakerphone

Telephone interviews were conducted with:

- RichPly - Angus Allison
- Western Forest Products Paul Bavis - Management Forester
- Western Forest Products- Rich Lungren - Log Trader
- Teal Cedar - Jack Macleod - Log Trader
- Weyerhaeuser - Bart Bjarnson - Log Trader
- Weyerhaeuser - Peter Kofoed - Management Forester
- BCTS - Guy Fried- Forester
- Les Jozsa, Research Scientist Emeritus, Forintek Canada Corp.
- Brian Zak, Chief Operating Officer, Coast Forest and Lumber Association

Peter Drake, Consultant, provided information by email.

# Appendix B— Data Package

## B.0 Introduction

This document describes the data and assumptions used in this analysis, including second-growth grade distributions and expected revenues determined in part from licensees' inputs during the course of this study.

The operability criteria for second-growth stands are also listed. Other forest management assumptions – including forest cover requirements, utilization levels and standards, un-salvaged losses, and green-up assumptions – are unchanged from the current TSR and TFL MWPs.

## B.0 HG/QCI Second-growth Study Land Base

Based on licensee data and site descriptions for existing second-growth and fire-origin stands, the land base has been aggregated into 12 forest types (leading species and site index groupings). 10-year age classes have also been used.

Table B-1 lists the analysis unit groupings used. The timber harvesting land base (THLB) area for the productive forest is listed in Table B-2. Table B-2 also lists the THLB area for existing second-growth stands. At this time, existing harvest-origin stands are defined following the rules supplied in the management plans and TSR2 data package. Also supplied is the assumed second-growth area for fire-origin stands.

**Table B-1. Forest type definitions.**

| Forest Type | Leading Species | Site Index | Weighted Site Index |
|---|---|---|---|
| HwSs_Good | Hemlock | SI 35+ | |
| HwSs_Med | Hemlock | 26 < SI <= 34 | |
| HwSs_Poor | Hemlock | 15 < SI <= 26 | |
| HwSs_Low | Hemlock | SI <= 15 | 13.29 |
| SsHw_Good | Spruce | SI 35+ | |
| SsHw_Med | Spruce | 26 < SI <= 34 | |
| SsHw_Poor | Spruce | 15 < SI <= 26 | |
| SsHw_Low | Spruce | SI <= 15 | 12.27 |
| Cw_Good | Cedar | SI 35+ | |
| Cw_Med | Cedar | 26 < SI <= 34 | |
| Cw_Poor | Cedar | 15 < SI <= 26 | |
| Cw_Low | Cedar | SI <= 15 | 13.1 |

Forest species composition codes used in Table B-1: Hw= western hemlock; Ss=Sitka spruce; Cw= western red cedar.

**Table B-2. THLB for the second-growth productive forest**

| Forest Types | Site Index | Fire origin (Tlell fire) | Harvest-origin age ≤ 60 years | Existing Natural age > 60 years | Total Operable Forest |
|---|---|---|---|---|---|
| Cw_Med | 26 < SI <= 34 | | 35 | 8 | 43 |
| Cw_Poor | 15 < SI <= 26 | 3,844 | 1,507 | 21,231 | 26,583 |
| Cw_Low | SI <= 15 | 949 | 532 | 42,995 | 44,476 |
| HwSs_Good | SI 35+ | | 115 | 18 | 133 |
| HwSs_Med | 26 < SI <= 34 | | 26,167 | 2,973 | 29,140 |
| HwSs_Poor | 15 < SI <= 26 | 174 | 25,441 | 33,937 | 59,552 |
| HwSs_Low | SI <= 15 | 4 | 8,172 | 29,166 | 37,342 |
| SsHw_Good | SI 35+ | | 1,087 | 58 | 1,145 |
| SsHw_Med | 26 < SI <= 34 | | 12,667 | 1,658 | 14,324 |
| SsHw_Poor | 15 < SI <= 26 | 3 | 7,531 | 6,054 | 13,588 |
| SsHw_Low | SI <= 15 | 0 | 5,548 | 6,933 | 12,481 |
| **Total** | | 4,974 | 88,801 | 145,032 | 238,806 |

## B3.0 Second-growth Yields, Grade Percentages, and Values

Updated values and grade percentages have been obtained for second-growth stands within the HG/QCI. The values and grades are broken up by species, site quality and age. The values and grades have been broken up by two stand types: harvest-origin and fire-origin. Fire-origin data will be used for existing stands aged 115 - 140 within the identified Tlell fire boundary.

Four grades have been identified for second-growth stands: Utility ("X" and "U" grade), coarse, peeler, tight ring ("J" grade), and high value (sawlog). Table B-3 lists the grade prices per $m^3$.

**Table B-3. Grade prices per $m^3$.**

| | Price (Cdn $) per $m^3$ | | | | |
|---|---|---|---|---|---|
| | "X" and "U" Grade | "J" Grade | | | High Value |
| | Utility | Coarse | Peeler | Tight ring | Sawlog |
| **Harvest-origin** | | | | | |
| Hw | 40 | - | - | 50 | 60 |
| Cw | 65 | - | - | 150 | 160 |
| Ss | 40 | 50 | 70 | 65 | 75 |
| **Fire established** | | | | | |
| Hw | 40 | 45 | - | 50 | 60 |
| Cw | 65 | 105 | - | 160 | 160 |
| Ss | 40 | 50 | 70 | 65 | 75 |

Hw= western hemlock; Ss=Sitka spruce; Cw= western red cedar.

Volumes, grade percentages, and values have been calculated for species/site groupings (Tables C-4 to C-13). Using Table B-4 as an example, stand value can be calculated by multiplying value by volume. For example a 525 $m^3$/ha HwSs, good site (SI 35+) stand aged 50 will yield a value of $27,038 $/ha (stand value of 51.5 $/$m^3$ × 525 $m^3$/ha).

**Table B-4. Managed HwSs Good site yields, grade percentages, and value.**

| | | "X" and "U" Grade | | "J" Grade | | Good Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **HwSs_Good - Age 30** | | | | | | | |
| 225 | Hw | 20% | 20% | | 60% | 0% | 100% |
| 25 | Cw | 10% | | | 90% | 0% | 100% |
| 100 | Ss | 20% | 20% | 60% | 0% | 0% | 100% |
| 350 | Volume | 67.5 | 65 | 60 | 157.5 | 0 | 350 |
| Grade Percent Total | | 19% | 19% | 17% | 45% | 0% | 100% |
| Value Total ($) | | 7.9 | 8.6 | 12.0 | 28.9 | 0.0 | 57.5 |
| **HwSs_Good - Age 40** | | | | | | | |
| 300 | Hw | 10% | 25% | | 55% | 10% | 100% |
| 25 | Cw | 10% | | | 90% | 0% | 100% |
| 175 | Ss | 15% | 65% | 20% | 0% | 0% | 100% |
| 500 | Volume | 58.75 | 188.75 | 35 | 187.5 | 30 | 500 |
| Grade Percent Total | | 12% | 38% | 7% | 38% | 6% | 100% |
| Value Total ($) | | 4.8 | 18.1 | 4.9 | 23.3 | 3.6 | 54.7 |
| **HwSs_Good - Age 50** | | | | | | | |
| 400 | Hw | 15% | 20% | | 50% | 15% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 125 | Ss | 10% | 40% | 40% | 0% | 10% | 100% |
| 525 | Volume | 72.5 | 130 | 50 | 200 | 72.5 | 525 |
| Grade Percent Total | | 14% | 25% | 10% | 38% | 14% | 100% |
| Value Total ($) | | 5.5 | 11.6 | 6.7 | 19.0 | 8.6 | 51.5 |
| **HwSs_Good - Age 60** | | | | | | | |
| 420 | Hw | 15% | 10% | | 60% | 15% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 130 | Ss | 10% | 30% | 30% | 20% | 10% | 100% |
| 550 | Volume | 76 | 81 | 39 | 278 | 76 | 550 |
| Grade Percent Total | | 14% | 15% | 7% | 51% | 14% | 100% |
| Value Total ($) | | 5.5 | 7.0 | 5.0 | 26.0 | 8.6 | 52.1 |

**Table B-5. Managed HwSs medium site yields, grade percentages, and value.**

| | | "X" and "U" Grade | "J" Grade | | | High Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **HwSs_Med - Age 30** | | | | | | | |
| 65 | Hw | 25% | 35% | | 40% | 0% | 100% |
| 5 | Cw | 25% | | | 75% | 0% | 100% |
| 30 | Ss | 25% | 25% | 35% | 15% | 0% | 100% |
| 100 | | 25 | 30.25 | 10.5 | 34.25 | 0 | 100 |
| Grade Percent Total | | 25% | 30% | 11% | 34% | 0% | 100% |
| Value Total ($) | | 10.3 | 14.0 | 7.4 | 21.6 | 0.0 | 53.2 |
| **HwSs_Med - Age 40** | | | | | | | |
| 225 | Hw | 15% | 15% | | 70% | 0% | 100% |
| 25 | Cw | 25% | | | 75% | 0% | 100% |
| 125 | Ss | 15% | 50% | 35% | 0% | 0% | 100% |
| 375 | | 58.75 | 96.25 | 43.75 | 176.25 | 0 | 375 |
| Grade Percent Total | | 16% | 26% | 12% | 47% | 0% | 100% |
| Value Total ($) | | 6.7 | 12.4 | 8.2 | 28.5 | 0.0 | 55.7 |
| **HwSs_Med - Age 50** | | | | | | | |
| 275 | Hw | 25% | 30% | | 45% | 0% | 100% |
| 5 | Cw | 25% | | | 75% | 0% | 100% |
| 150 | Ss | 15% | 50% | 25% | 10% | 0% | 100% |
| 430 | | 92.5 | 157.5 | 37.5 | 142.5 | 0 | 430 |
| Grade Percent Total | | 22% | 37% | 9% | 33% | 0% | 100% |
| Value Total ($) | | 8.7 | 17.4 | 6.1 | 18.0 | 0.0 | 50.1 |
| **HwSs_Med - Age 60** | | | | | | | |
| 300 | Hw | 20% | 20% | | 50% | 10% | 100% |
| 5 | Cw | 25% | | | 75% | 0% | 100% |
| 170 | Ss | 15% | 25% | 25% | 30% | 5% | 100% |
| 475 | | 86.75 | 102.5 | 42.5 | 204.75 | 38.5 | 475 |
| Grade Percent Total | | 18% | 22% | 9% | 43% | 8% | 100% |
| Value Total ($) | | 7.4 | 10.2 | 6.3 | 24.0 | 5.1 | 52.9 |

**Table B-6. Harvest-origin HwSs poor site yields, grade percentages, and value.**

| | | "X" and "U" Grade | | "J" Grade | | High Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **HwSs_Poor - Age 30** | | | | | | | |
| 40 | Hw | 50% | 30% | | 20% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 20 | Ss | 25% | 30% | 25% | 20% | 0% | 100% |
| 60 | | 25 | 18 | 5 | 12 | 0 | 60 |
| Grade Percent Total | | 42% | 30% | 8% | 20% | 0% | 100% |
| Value | | 16.7 | 14.0 | 5.8 | 11.0 | 0.0 | 47.5 |
| **HwSs_Poor - Age 40** | | | | | | | |
| 60 | Hw | 15% | 10% | | 75% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 40 | Ss | 25% | 25% | 40% | 10% | 0% | 100% |
| 100 | | 19 | 16 | 16 | 49 | 0 | 100 |
| Grade Percent Total | | 19% | 16% | 16% | 49% | 0% | 100% |
| Value | | 7.6 | 7.7 | 11.2 | 25.1 | 0.0 | 51.6 |
| **HwSs_Poor - Age 50** | | | | | | | |
| 60 | Hw | 50% | 30% | | 20% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 40 | Ss | 25% | 20% | 25% | 30% | 0% | 100% |
| 100 | | 40 | 26 | 10 | 24 | 0 | 100 |
| Grade Percent Total | | 40% | 26% | 10% | 24% | 0% | 100% |
| Value | | 16.0 | 12.1 | 7.0 | 13.8 | 0.0 | 48.9 |
| **HwSs_Poor - Age 60** | | | | | | | |
| 90 | Hw | 40% | 30% | | 30% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 60 | Ss | 20% | 25% | 15% | 40% | 0% | 100% |
| 150 | | 48 | 42 | 9 | 51 | 0 | 150 |
| Grade Percent Total | | 32% | 28% | 6% | 34% | 0% | 100% |
| Value | | 12.8 | 13.1 | 4.2 | 19.4 | 0.0 | 49.5 |

**Table B-7. Harvest-origin SsHw high site yields, grade percentages, and value.**

| | | "X" and "U" Grade | | "J" Grade | | High Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **SsHw_Good - Age 30** | | | | | | | |
| 60 | Hw | 35% | 25% | | 40% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 350 | Ss | 20% | 25% | 55% | 0% | 0% | 100% |
| 410 | | 91 | 102.5 | 192.5 | 24 | 0 | 410 |
| Grade Percent Total | | 22% | 25% | 47% | 6% | 0% | 100% |
| Value | | 8.9 | 12.3 | 32.9 | 2.9 | 0.0 | 57.0 |
| **SsHw_Good - Age 40** | | | | | | | |
| 200 | Hw | 10% | 10% | | 70% | 10% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 400 | Ss | 15% | 50% | 35% | 0% | 0% | 100% |
| 600 | | 80 | 220 | 140 | 140 | 20 | 600 |
| Grade Percent Total | | 13% | 37% | 23% | 23% | 3% | 100% |
| Value | | 5.3 | 18.2 | 16.3 | 11.7 | 2.0 | 53.5 |
| **SsHw_Good - Age 50** | | | | | | | |
| 150 | Hw | 35% | 25% | | 40% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 500 | Ss | 15% | 40% | 35% | 0% | 10% | 100% |
| 700 | | 135 | 257.5 | 192.5 | 60 | 55 | 700 |
| Grade Percent Total | | 19% | 37% | 28% | 9% | 8% | 100% |
| Value | | 7.7 | 18.1 | 19.3 | 4.3 | 5.9 | 55.3 |
| **SsHw_Good - Age 60** | | | | | | | |
| 150 | Hw | 22% | 15% | | 55% | 8% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 650 | Ss | 5% | 30% | 20% | 10% | 35% | 100% |
| 800 | | 65.5 | 217.5 | 130 | 147.5 | 239.5 | 800 |
| Grade Percent Total | | 8% | 27% | 16% | 18% | 30% | 100% |
| Value | | 3.3 | 13.5 | 11.4 | 10.4 | 22.2 | 60.8 |
| **SsHw_Good - Age 80** | | | | | | | |
| 250 | Hw | 15% | 0% | | 65% | 20% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 750 | Ss | 5% | 10% | 10% | 25% | 50% | 100% |
| 1000 | | 75 | 75 | 75 | 350 | 425 | 1000 |
| Grade Percent Total | | 8% | 8% | 8% | 35% | 43% | 100% |
| Value | | 3.0 | 3.8 | 5.3 | 20.3 | 31.1 | 63.4 |

**Table B-8. Harvest-origin SsHw medium site yields, grade percentages, and value.**

| | | "X" and "U" Grade | "J" Grade | | | High Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **SsHw_Med - Age 30** | | | | | | | |
| 75 | Hw | 20% | 5% | | 75% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 125 | Ss | 25% | 25% | 50% | 0% | 0% | 100% |
| 200 | | 46.25 | 35 | 62.5 | 56.25 | 0 | 200 |
| Grade Percent Total | | 23% | 18% | 31% | 28% | 0% | 100% |
| Value | | 9.3 | 8.7 | 21.9 | 14.1 | 0.0 | 53.8 |
| **SsHw_Med - Age 40** | | | | | | | |
| 160 | Hw | 10% | 10% | | 80% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 250 | Ss | 15% | 35% | 40% | 10% | 0% | 100% |
| 410 | | 53.5 | 103.5 | 100 | 153 | 0 | 410 |
| Grade Percent Total | | 13% | 25% | 24% | 37% | 0% | 100% |
| Value | | 5.2 | 12.4 | 17.1 | 19.6 | 0.0 | 54.3 |
| **SsHw_Med - Age 50** | | | | | | | |
| 165 | Hw | 25% | 10% | | 65% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 300 | Ss | 15% | 40% | 30% | 10% | 5% | 100% |
| 465 | | 86.25 | 136.5 | 90 | 137.25 | 15 | 465 |
| Grade Percent Total | | 19% | 29% | 19% | 30% | 3% | 100% |
| Value | | 7.4 | 14.5 | 13.5 | 15.7 | 2.4 | 53.6 |
| **SsHw_Med - Age 60** | | | | | | | |
| 100 | Hw | 25% | 10% | | 60% | 5% | 100% |
| 0 | Cw | 0% | 0% | 0% | 0% | 0% | 0% |
| 400 | Ss | 15% | 25% | 15% | 20% | 25% | 100% |
| 500 | | 85 | 110 | 60 | 140 | 105 | 500 |
| Grade Percent Total | | 17% | 22% | 12% | 28% | 21% | 100% |
| Value | | 6.8 | 10.9 | 8.4 | 16.4 | 15.6 | 58.1 |
| **SsHw_Med - Age 80** | | | | | | | |
| 200 | Hw | 15% | 0% | | 70% | 15% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 600 | Ss | 10% | 10% | 10% | 35% | 35% | 100% |
| 800 | | 90 | 60 | 60 | 350 | 240 | 800 |
| Grade Percent Total | | 11% | 8% | 8% | 44% | 30% | 100% |
| Value | | 4.5 | 3.8 | 5.3 | 25.8 | 21.9 | 61.3 |

**Table B-9. Harvest-origin SsHw poor site yields, grade percentages, and value.**

| | | "X" and "U" Grade | | "J" Grade | | High Value | |
|---|---|---|---|---|---|---|---|
| Vol | Species | Utility | Coarse | Peeler | Tight ring | Sawlog | Total |
| **SsHw_Poor - Age 30** | | | | | | | |
| 20 | Hw | 20% | 0% | | 80% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 50 | Ss | 25% | 25% | 50% | 0% | 0% | 100% |
| 70 | | 16.5 | 12.5 | 25 | 16 | 0 | 70 |
| Grade Percent Total | | 24% | 18% | 36% | 23% | 0% | 100% |
| Value | | 9.4 | 8.9 | 25.0 | 11.4 | 0.0 | 54.8 |
| **SsHw_Poor - Age 40** | | | | | | | |
| 50 | Hw | 10% | 15% | | 75% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 110 | Ss | 15% | 25% | 40% | 20% | 0% | 100% |
| 160 | | 21.5 | 35 | 44 | 59.5 | 0 | 160 |
| Grade Percent Total | | 13% | 22% | 28% | 37% | 0% | 100% |
| Value | | 5.4 | 10.7 | 19.3 | 20.7 | 0.0 | 56.0 |
| **SsHw_Poor - Age 50** | | | | | | | |
| 75 | Hw | 30% | 0% | | 70% | 0% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 150 | Ss | 25% | 35% | 20% | 20% | 0% | 100% |
| 225 | | 60 | 52.5 | 30 | 82.5 | 0 | 225 |
| Grade Percent Total | | 27% | 23% | 13% | 37% | 0% | 100% |
| Value | | 10.7 | 11.7 | 9.3 | 20.3 | 0.0 | 52.0 |
| **SsHw_Poor - Age 60** | | | | | | | |
| 60 | Hw | 30% | 0% | | 65% | 5% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 270 | Ss | 25% | 20% | 10% | 30% | 15% | 100% |
| 330 | | 85.5 | 54 | 27 | 120 | 43.5 | 330 |
| Grade Percent Total | | 26% | 16% | 8% | 36% | 13% | 100% |
| Value | | 10.4 | 8.2 | 5.7 | 21.9 | 9.8 | 55.9 |
| **SsHw_Poor - Age 80** | | | | | | | |
| 125 | Hw | 15% | 0% | | 75% | 10% | 100% |
| 0 | Cw | 0% | | | 0% | 0% | 0% |
| 350 | Ss | 20% | 10% | 15% | 40% | 15% | 100% |
| 475 | | 88.75 | 35 | 52.5 | 233.75 | 65 | 475 |
| Grade Percent Total | | 19% | 7% | 11% | 49% | 14% | 100% |
| Value | | 7.5 | 3.7 | 7.7 | 29.0 | 9.9 | 57.8 |

**Table B-10. Fire origin Cw medium site yields, grade percentages, and value.**

| Vol | Species | "X" and "U" Grade Utility | "J" Grade Coarse | "J" Grade Peeler | "J" Grade Tight ring | High Value Sawlog | Total |
|---|---|---|---|---|---|---|---|
| **Cw_Med - Age 120** | | | | | | | |
| 250 | Hw | 30% | 20% | | 50% | 0% | 100% |
| 450 | Cw | 15% | 15% | | 35% | 35% | 100% |
| 25 | Ss | 0% | 0% | 0% | 100% | 0% | 100% |
| 725 | | 142.5 | 117.5 | 0 | 307.5 | 157.5 | 725 |
| Grade Percent Total | | 20% | 16% | 0% | 42% | 22% | 100% |
| Value | | 10.2 | 12.9 | 0.0 | 45.6 | 34.8 | 103.4 |

**Table B-11. Fire origin Cw poor site yields, grade percentages, and value.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Cw_Poor - Age 120** | | | | | | | |
| 200 | Hw | 30% | 20% | | 50% | 0% | 100% |
| 350 | Cw | 15% | 20% | | 40% | 25% | 100% |
| 0 | Ss | 0% | 0% | 0% | 0% | 0% | 0% |
| 550 | | 112.5 | 110 | 0 | 240 | 87.5 | 550 |
| Grade Percent Total | | 20% | 20% | 0% | 44% | 16% | 100% |
| Value | | 10.6 | 16.6 | 0.0 | 49.8 | 25.5 | 102.5 |

**Table B-12. Fire origin HwCw(Ss) medium site yields, grade percentages, and value.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **HwCw_Med - Age 120** | | | | | | | |
| 350 | Hw | 20% | 30% | | 50% | 0% | 100% |
| 250 | Cw | 15% | 20% | | 40% | 25% | 100% |
| 25 | Ss | 0% | 0% | 0% | 100% | 0% | 100% |
| 625 | | 107.5 | 155 | 0 | 300 | 62.5 | 625 |
| Grade Percent Total | | 17% | 25% | 0% | 48% | 10% | 100% |
| Value | | 8.4 | 16.0 | 0.0 | 42.2 | 16.0 | 82.5 |

**Table B-13. Fire origin HwCw(Ss) poor site yields, grade percentages, and value.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **HwCw_Poor - Age 120** | | | | | | | |
| 250 | Hw | 20% | 40% | | 40% | 0% | 100% |
| 150 | Cw | 20% | 30% | | 35% | 15% | 100% |
| 10 | Ss | 0% | 0% | 0% | 100% | 0% | 100% |
| 410 | | 80 | 145 | 0 | 162.5 | 22.5 | 410 |
| Grade Percent Total | | 20% | 35% | 0% | 40% | 5% | 100% |
| Value | | 9.6 | 22.5 | 0.0 | 34.3 | 8.8 | 75.2 |

## B4.0 Operability Criteria

Harvest age has been used to define operability criteria. The minimum harvestable age is the time required for a stand to grow to a harvestable size, and defines the lower limit for harvesting. Harvesting can occur in stands at or above the minimum harvest age.

Table B-14 defines the minimum harvest ages for second-growth stands. These harvest ages were developed by John Cookman (HiMark Forest Consultants) based on advice received from licensees.

**Table B-14. Minimum harvest age definitions, HG/QCI second-growth analysis**

| Analysis Unit | Minimum Harvest Age |
|---|---|
| HwSs_Good | 40 |
| HwSs_Med | 50 |
| HwSs_Poor | 60 |
| HwSs_Low | 60 |
| SsHw_Good | 40 |
| SsHw_Med | 50 |
| SsHw_Poor | 60 |
| SsHw_Low | 60 |
| CwHw_Good | 40 |
| CwHw_Med | 50 |
| CwHw_Poor | 60 |
| CwHw_Low | 60 |

# Appendix C — Second-Growth Harvest Potential

**Table C-1 Simulated potential harvest volume ($m^3$/decade) for years 2004-2053**

| PTT ID | PTT Name | Period 2004-2013 | 2014-2023 | 2024-2033 | 2034-2043 | 2044-2053 |
|---|---|---|---|---|---|---|
| 1 | Newcombe Inlet | - | 4,664 | 69,107 | 248,025 | 93,123 |
| 2 | Kootenay Inlet | - | - | - | 5 | - |
| 3 | Fairfax Inlet | - | - | - | - | - |
| 4 | Botany Inlet | - | - | 19,768 | 63,160 | 103,139 |
| 10 | Skidegate Lake | 53,394 | 1,571,590 | 834,850 | 156,653 | 140,303 |
| 11 | Skidegate Channel | - | 9,740 | 14,136 | - | 11,615 |
| 12 | Haans Creek | - | 74,364 | 11,946 | 207,499 | 108,237 |
| 13 | Gray Bay Cumshewa | 2,448 | 238,542 | 41,457 | - | 25,853 |
| 14 | Deena Creek | - | 17,879 | 360,659 | 127,153 | 72,565 |
| 15 | Aero Camp | 12,336 | 328,470 | 190,169 | 25,430 | - |
| 16 | Alliford Bay | - | 261,380 | 247,063 | 283,879 | 147,003 |
| 17 | Tangil Penninsula | - | 3,479 | 83,137 | 20,812 | - |
| 18 | Talunkwan Island | 4,380 | 8,110 | 48,197 | 264,257 | 67,063 |
| 19 | Sewell Inlet | - | 335 | 97,521 | 338,355 | 96,780 |
| 20 | Pacofi Bay | 13,862 | 31,965 | 64,821 | 350,254 | 58,730 |
| 21 | Newcombe Peak | - | 69,592 | 51,172 | 1,488 | - |
| 22 | Mosquito Lake | - | - | 436,869 | 107,924 | 2,313 |
| 23 | Lagoon Inlet | - | - | 61,941 | 16,559 | 3,309 |
| 26 | Crescent Inlet | - | - | 22 | 8,656 | 38,175 |
| 30 | Sedans Creek | - | 13,403 | 946 | - | 175,251 |
| 31 | Rockfish Harbour | - | - | - | 6,594 | 62,627 |
| 32 | Mathers Creek | - | 65,013 | 6,573 | 139,636 | 109,366 |
| 33 | Waste Creek | - | - | 218 | 17,006 | 102,737 |
| 34 | Breaker Bay Creek | - | 13,468 | 1,012 | - | 41,186 |
| 35 | Beattie Anchorage | 8,286 | 54,872 | 16,584 | 43,535 | 24,916 |
| 37 | Bottle Inlet | - | - | - | - | - |
| 38 | Security Inlet | - | - | - | 1,114 | - |
| 39 | Kuper Inlet | - | - | 37,314 | 20,274 | 796 |
| 40 | Kitgoro Inlet | - | 4 | - | 2,061 | 4,023 |
| 41 | Inskip Channel | - | - | - | - | - |
| 42 | Hibben Island | - | - | - | - | 1,316 |
| 43 | Government Creek | - | - | - | 1,974 | 850 |
| 44 | Chaatl Island | - | - | - | 1,148 | 384 |
| 51 | Phantom Creek | - | - | - | 6,708 | 21,781 |
| 52 | Upper Yakoun River | 948 | 111,743 | 234,647 | 277,842 | 258,676 |
| 53 | Yakoun Lake | - | - | 11,826 | 18,972 | 44,388 |
| 54 | King Creek | - | 2,515 | 35,446 | 74,282 | 148,678 |
| 55 | Ghost Creek | - | - | 56,920 | 154,795 | 131,084 |
| 56 | Brent Creek | - | - | 107,149 | 265,237 | 173,724 |
| 57 | Survey Creek | 123,959 | - | 13,911 | 234,832 | 230,061 |
| 58 | Lower Tlell River | 879,999 | - | - | 1,604 | 2,752 |
| 59 | Lella Creek | 477,650 | - | - | - | 9,907 |
| 60 | Geike Creek | 215,446 | - | - | - | - |
| 61 | Feather Creek | 106,728 | - | - | - | - |
| 62 | Lawn Hill | 61,843 | - | 86 | 315 | 7,153 |
| 63 | Three Mile Creek | - | - | - | 36,133 | 135,217 |
| 64 | Tartu Inlet | - | - | - | - | 20,018 |
| 65 | Shields Bay | 276 | - | 14,399 | 16,847 | 12,413 |
| 66 | Seal Inlet | - | - | - | - | - |
| 67 | Riley Creek | - | - | - | 1,538 | 14,623 |
| 68 | Bill Brown Creek | - | - | 729 | - | - |
| 69 | Hangover Creek | - | - | - | - | 2,619 |
| 70 | Gregory Creek | - | - | - | 1,032 | 1,722 |
| 71 | Bonanza Creek | - | - | - | 29,064 | 34,682 |
| 72 | Wia Point | - | - | - | - | - |
| 73 | Sewall Creek | - | - | 8,818 | 13,471 | 33,172 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 74 | Otun River | - | - | - | - | - |
| 75 | Kitt Hawn Creek | - | - | - | 3,774 | - |
| 76 | Hancock River | - | - | - | 3 | - |
| 77 | Craft Bay | - | - | - | - | - |
| 78 | Christie River | - | - | - | - | - |
| 79 | Kumdis Island | - | 8,183 | 9,891 | - | - |
| 80 | Watun River | - | - | - | - | 3,896 |
| 81 | Skonun River | - | - | - | 335 | - |
| 84 | Mayer Lake | 131,000 | - | - | - | - |
| 85 | Kumdis Creek | 309,047 | - | - | - | 1,845 |
| 87 | Cape Ball Creek | - | - | - | - | - |
| 88 | Boulton Lake | 35,613 | - | - | - | - |
| 89 | Buckley Bay | - | - | - | 302,990 | 230,572 |
| 90 | McClinton Bay | - | - | - | - | 310,517 |
| 91 | Mamin River | 42,756 | 108,491 | 587,486 | 282,298 | 77,095 |
| 92 | Towustasin Hill | - | 102,668 | 105,354 | 133,167 | 186,162 |
| 93 | Dinan Bay | - | - | - | 122,903 | 209,626 |
| 94 | Datlamen Creek | - | - | - | - | 270,862 |
| 95 | Cowhoe Bay | - | 4,145 | 16,545 | 86,389 | 53,282 |
| 96 | Blackwater Creek | - | 16,150 | 143,573 | 89,636 | 41,623 |
| 97 | Begbie Penninsula | - | 10,821 | 21,756 | - | 140,996 |
| 98 | Awun River | - | 1,046 | 710 | - | 196,683 |
| 99 | Lower Yakoun River | 126,229 | 168,339 | 108,352 | 114,904 | 74,980 |
| 100 | Log Creek | 329,534 | - | - | - | - |
| 101 | Gold Creek | 1,104 | 159,029 | 34,712 | 8,562 | 178,869 |
| 102 | Florence Creek | - | - | 119,634 | 199,853 | 209,270 |
| 103 | Canyon Creek | 32,526 | 42,800 | 28,883 | 110,881 | 29,262 |
| 104 | Blackbear Creek | - | - | - | - | - |
| 105 | Kung | - | - | - | - | 1,939 |
| 106 | Klashwun Point | - | - | - | - | - |
| 107 | Jalun River | - | - | - | - | - |
| 108 | Ian Southwest | - | - | - | - | 10,952 |
| 109 | Ian Northeast | - | - | - | - | - |
| 110 | Tara Creek | - | - | - | - | - |
| 111 | Ain River | - | 4,692 | - | 7,491 | 110,501 |
| 112 | Bill Creek | - | 1,805 | 2,534 | - | 19,986 |
| 113 | Ian Lake | - | - | - | 247,779 | 220,009 |
| 114 | Crease Creek | - | - | - | - | - |
| 115.1 | Trounce Inlet Option | - | - | - | 3,668 | 19 |
| 115.2 | Trounce Inlet | - | 2,422 | 4,324 | 4,765 | 11,720 |
| 116 | Slatechuck Creek | - | - | 6,908 | 24,263 | 67,045 |
| 117 | Queen Charlotte Skidegate | - | - | 7,629 | 6,617 | 20,338 |
| 118 | Renner Pass | 7,596 | 1,165 | 13,863 | 61,604 | 44,787 |
| 119 | Long Inlet | - | - | 3,222 | 9,609 | 25,177 |
| 120 | Honna River | - | - | 128,433 | 54,257 | 105,132 |
| 121 | Gudal Bay | - | - | - | - | 3,676 |
| 122 | Kano Inlet | - | - | - | - | 8,504 |
| 123 | Dawson Inlet | - | - | - | 433 | 74 |
| 124 | Dawson Harbour | - | - | 1,313 | 6,032 | 327 |
| 125 | Stanley Creek | - | - | - | 1,190 | 35,422 |
| 126 | Roy Lake | - | - | - | - | 15,931 |
| 127 | Lignite Creek | - | - | 7,719 | 32,023 | 41,000 |
| 128 | Naden River | - | - | 3,199 | 137,266 | 140,824 |
| 129 | Davidson Creek | - | - | 843 | 697 | 198,372 |
| 130 | Sialun Creek | - | - | - | - | - |
| 131 | Lepas Bay | - | - | - | 267 | - |
| 133 | Hana Koot Creek | - | - | 357 | - | - |
| 134 | Haines Creek | - | - | - | - | 5,032 |
| 135 | Cave Creek | - | - | - | 14,155 | 4,330 |
| 136 | Beresford Creek | - | - | - | - | - |
| 137 | Tian Head | - | - | - | - | - |
| 139 | Otard Creek | - | - | - | - | - |
| 140 | Mercer Lake | - | - | - | - | - |
| 141 | Hosu Cove | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 143 | Fortier Hill | - | - | - | - | - |
| 144 | Coates Creek | - | - | - | - | - |
| 145 | Athlow Bay | - | - | - | - | - |
| | | 2,976,960 | 3,512,881 | 4,536,651 | 5,653,932 | 6,080,970 |

**Table C-2 Simulated potential harvest area (ha/decade) for years 2004-2053**

| PTT ID | PTT Name | Period 2004-2013 | 2014-2023 | 2024-2033 | 2034-2043 | 2044-2053 |
|---|---|---|---|---|---|---|
| 1 | Newcombe Inlet | - | 8 | 116 | 535 | 314 |
| 2 | Kootenay Inlet | - | - | - | 0 | - |
| 3 | Fairfax Inlet | - | - | - | - | - |
| 4 | Botany Inlet | - | - | 34 | 147 | 250 |
| 10 | Skidegate Lake | 89 | 3,447 | 2,955 | 491 | 537 |
| 11 | Skidegate Channel | - | 23 | 44 | - | 32 |
| 12 | Haans Creek | - | 171 | 80 | 483 | 360 |
| 13 | Gray Bay Cumshewa | 4 | 521 | 176 | - | 108 |
| 14 | Deena Creek | - | 39 | 862 | 298 | 299 |
| 15 | Aero Camp | 21 | 734 | 786 | 133 | - |
| 16 | Alliford Bay | - | 593 | 613 | 726 | 596 |
| 17 | Tangil Penninsula | - | 8 | 309 | 139 | - |
| 18 | Talunkwan Island | 7 | 17 | 126 | 654 | 426 |
| 19 | Sewell Inlet | - | 1 | 231 | 790 | 362 |
| 20 | Pacofi Bay | 24 | 74 | 172 | 852 | 194 |
| 21 | Newcombe Peak | - | 150 | 196 | 8 | - |
| 22 | Mosquito Lake | - | - | 1,852 | 522 | 15 |
| 23 | Lagoon Inlet | - | - | 225 | 45 | 17 |
| 26 | Crescent Inlet | - | - | 0 | 20 | 89 |
| 30 | Sedans Creek | - | 30 | 6 | - | 389 |
| 31 | Rockfish Harbour | - | - | - | 14 | 139 |
| 32 | Mathers Creek | - | 149 | 44 | 324 | 301 |
| 33 | Waste Creek | - | - | 1 | 40 | 315 |
| 34 | Breaker Bay Creek | - | 31 | 5 | - | 90 |
| 35 | Beattie Anchorage | 14 | 121 | 97 | 101 | 92 |
| 37 | Bottle Inlet | - | - | - | - | - |
| 38 | Security Inlet | - | - | - | 3 | - |
| 39 | Kuper Inlet | - | - | 86 | 46 | 2 |
| 40 | Kitgoro Inlet | - | 0 | - | 14 | 12 |
| 41 | Inskip Channel | - | - | - | - | - |
| 42 | Hibben Island | - | - | - | - | 3 |
| 43 | Government Creek | - | - | - | 5 | 3 |
| 44 | Chaatl Island | - | - | - | 8 | 3 |
| 51 | Phantom Creek | - | - | - | 16 | 51 |
| 52 | Upper Yakoun River | 2 | 238 | 622 | 722 | 612 |
| 53 | Yakoun Lake | - | - | 26 | 44 | 103 |
| 54 | King Creek | - | 6 | 107 | 187 | 349 |
| 55 | Ghost Creek | - | - | 118 | 360 | 303 |
| 56 | Brent Creek | - | - | 243 | 612 | 497 |
| 57 | Survey Creek | 225 | - | 30 | 542 | 535 |
| 58 | Lower Tlell River | 1,622 | - | - | 3 | 5 |
| 59 | Lella Creek | 874 | - | - | - | 23 |
| 60 | Geike Creek | 392 | - | - | - | - |
| 61 | Feather Creek | 194 | - | - | - | - |
| 62 | Lawn Hill | 112 | - | 0 | 2 | 28 |
| 63 | Three Mile Creek | - | - | - | 84 | 335 |
| 64 | Tartu Inlet | - | - | - | - | 44 |
| 65 | Shields Bay | 0 | - | 33 | 46 | 49 |
| 66 | Seal Inlet | - | - | - | - | - |
| 67 | Riley Creek | - | - | - | 5 | 59 |
| 68 | Bill Brown Creek | - | - | 2 | - | - |
| 69 | Hangover Creek | - | - | - | - | 6 |
| 70 | Gregory Creek | - | - | - | 2 | 7 |
| 71 | Bonanza Creek | - | - | - | 63 | 168 |
| 72 | Wia Point | - | - | - | - | - |
| 73 | Sewall Creek | - | - | 23 | 79 | 203 |
| 74 | Otun River | - | - | - | - | - |
| 75 | Kitt Hawn Creek | - | - | - | 20 | - |
| 76 | Hancock River | - | - | - | 0 | - |
| 77 | Craft Bay | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 78 | Christie River | - | - | - | - | - |
| 79 | Kumdis Island | - | 18 | 66 | - | - |
| 80 | Watun River | - | - | - | - | 9 |
| 81 | Skonun River | - | - | - | 2 | - |
| 84 | Mayer Lake | 241 | - | - | - | - |
| 85 | Kumdis Creek | 573 | - | - | - | 10 |
| 87 | Cape Ball Creek | - | - | - | - | - |
| 88 | Boulton Lake | 65 | - | - | - | - |
| 89 | Buckley Bay | - | - | - | 703 | 577 |
| 90 | McClinton Bay | - | - | - | - | 713 |
| 91 | Mamin River | 71 | 233 | 1,447 | 691 | 353 |
| 92 | Towustasin Hill | - | 232 | 261 | 337 | 439 |
| 93 | Dinan Bay | - | - | - | 279 | 487 |
| 94 | Datlamen Creek | - | - | - | - | 628 |
| 95 | Cowhoe Bay | - | 10 | 110 | 200 | 271 |
| 96 | Blackwater Creek | - | 33 | 350 | 246 | 104 |
| 97 | Begbie Penninsula | - | 23 | 53 | - | 322 |
| 98 | Awun River | - | 2 | 5 | - | 452 |
| 99 | Lower Yakoun River | 219 | 356 | 335 | 291 | 210 |
| 100 | Log Creek | 601 | - | - | - | - |
| 101 | Gold Creek | 2 | 339 | 79 | 19 | 412 |
| 102 | Florence Creek | - | - | 275 | 479 | 740 |
| 103 | Canyon Creek | 54 | 95 | 86 | 289 | 68 |
| 104 | Blackbear Creek | - | - | - | - | - |
| 105 | Kung | - | - | - | - | 13 |
| 106 | Klashwun Point | - | - | - | - | - |
| 107 | Jalun River | - | - | - | - | - |
| 108 | Ian Southwest | - | - | - | - | 25 |
| 109 | Ian Northeast | - | - | - | - | - |
| 110 | Tara Creek | - | - | - | - | - |
| 111 | Ain River | - | 10 | - | 17 | 258 |
| 112 | Bill Creek | - | 4 | 15 | - | 46 |
| 113 | Ian Lake | - | - | - | 576 | 584 |
| 114 | Crease Creek | - | - | - | - | - |
| 115.1 | Trounce Inlet Option | - | - | - | 15 | 0 |
| 115.2 | Trounce Inlet | - | 6 | 22 | 32 | 41 |
| 116 | Slatechuck Creek | - | - | 17 | 100 | 363 |
| 117 | Queen Charlotte Skidegate | - | - | 44 | 14 | 79 |
| 118 | Renner Pass | 13 | 2 | 31 | 243 | 229 |
| 119 | Long Inlet | - | - | 7 | 44 | 100 |
| 120 | Honna River | - | - | 297 | 142 | 450 |
| 121 | Gudal Bay | - | - | - | - | 10 |
| 122 | Kano Inlet | - | - | - | - | 38 |
| 123 | Dawson Inlet | - | - | - | 1 | 0 |
| 124 | Dawson Harbour | - | - | 3 | 18 | 2 |
| 125 | Stanley Creek | - | - | - | 3 | 116 |
| 126 | Roy Lake | - | - | - | - | 37 |
| 127 | Lignite Creek | - | - | 17 | 213 | 99 |
| 128 | Naden River | - | - | 7 | 335 | 736 |
| 129 | Davidson Creek | - | - | 2 | 2 | 597 |
| 130 | Sialun Creek | - | - | - | - | - |
| 131 | Lepas Bay | - | - | - | 2 | - |
| 133 | Hana Koot Creek | - | - | 2 | - | - |
| 134 | Haines Creek | - | - | - | - | 12 |
| 135 | Cave Creek | - | - | - | 30 | 10 |
| 136 | Beresford Creek | - | - | - | - | - |
| 137 | Tian Head | - | - | - | - | - |
| 139 | Otard Creek | - | - | - | - | - |
| 140 | Mercer Lake | - | - | - | - | - |
| 141 | Hosu Cove | - | - | - | - | - |
| 143 | Fortier Hill | - | - | - | - | - |
| 144 | Coates Creek | - | - | - | - | - |
| 145 | Athlow Bay | - | - | - | - | - |
| | | 5,419 | 7,721 | 13,751 | 14,509 | 17,962 |

## Appendix D — Glossary

*Allowable Annual Cut:* The allowable annual cut (AAC) is the amount of timber from public forest lands that can be harvested each year, expressed in cubic metres.

*Co-dominant:* a tree with a crown forming the general level of the crown canopy. The crown is generally smaller than that of the dominant trees and usually more crowded on the sides (Cruising manual p. 3-25, unofficial on-line copy).

*Conversion return*: the net profit following harvesting; revenues minus costs.

*Diameter-at-breast-height (dbh):* in the *timber cruise* the diameter of the tree is measured 1.3 metres from the point of germination to provide a reference point for sampling consistency.

*Dominant:* a tree with a crown extending above the general level of the crown canopy. Dominants are somewhat larger than the average and have well developed crowns which may be somewhat crowded on the sides (Cruising manual p. 3-25, unofficial on-line copy).

*Forest development plan (FDP):* an operational plan guided by the principles of integrated resource management (the consideration of timber and non timber values), which details the logistics of timber development over a period of usually five years. Methods, schedules, and responsibilities for accessing, harvesting, renewing, and protecting the resource are set out to enable site-specific operations to proceed. Under the new Forest and Range Practises Act, FDPs will no longer be required; instead Forest Stewardship Plans will be developed (from MoF website).

*Falldown:* There is a difference between the current rate of harvest (AAC) and the rate of harvest that can be sustained over the long term. The term "falldown" refers to the amount by which harvest levels must decline to meet sustainable long-term harvest levels.

*Fire origin* or *fire regenerated*: refers to second-growth stands that regenerated naturally following the Tlell fire of the late 1800s. There may be other second-growth stands that arose from smaller scattered fires, but these are grouped under "old forest" outside the Tlell boundary for mapping purposes.

*Harvest-origin*: refers to second-growth stands that regenerated (with or without planting) following logging. They may or may not be subject to management such as thinning and spacing. For the purposes of this study, we have defined harvest-origin second-growth forest as stands of age ≤ 60 years.

*Head-rig*: the initial saw in a mill that squares the log for further processing into dimension lumber.

*Leading species*: in a timber inventory an area is mapped to describe sub-areas that typically have different tree species that are dominant, and other species that are co-dominant on the site. The species that makes up the biggest portion of the timber type for that sub-area is called the *leading species*.

*Market Pricing System (MPS):* implemented on the Coast February 29, 2004, the Market Pricing System used to determine stumpage rates for an area designated for harvest uses a formula to derive the value of the stand to the Crown based on the costs to harvest and the existing market for logs in an area. The previous stumpage determination system, coined the "comparative value system," was based on hundreds of individual appraisals of timber stands, taking into account a number of factors affecting timber volumes. The process was slow and cumbersome, and did not

respond well to changing market conditions. In some cases, stumpage rates were too low, encouraging logging of stands that were not economical. At other times, stumpage rates were too high, reducing the forest sector's viability. The first case was used in US arguments at the core of the softwood lumber dispute that Canada unfairly subsidizes its lumber industry. Now, the province is establishing stumpage fees based on the timber's value on an open market. The new system requires a significant proportion of wood and fibre to be available on an open market in order to establish a true market value to use in the determination of stumpage for timber harvested from Crown lands.

*TFL Management and Working Plan (MWP)*: the holder of a Tree Farm Licence (TFL.) must prepare a Management and Working Plan, or more recently named a "Management Plan" that describes the forest management objectives for the licence area. This document, approved by the chief forester for B.C., sets the management strategies that consider other resource values to be considered in operational planning and also sets the bounds around the timber supply review prepared by the licensee for the plan area for chief forester approval.

*Old forest*: for mapping purposes only, "old forest" refers to natural origin mature and old forests that have not been logged and were not burned in the Tlell fire.

*Operability*: describes the physical or economic limitations to harvesting timber from an area. If an area is too steep to harvest or construct roads, prone to landslides, or does not have the physical timber piece-size in the forest stand, the stand is termed "physically inoperable." Economic operability shifts with the fluctuation of market prices for timber products and the costs to get them to market, so that areas that may be economically inoperable when prices are low may be operable when prices are high.

*Peeler*: a log grade, referred to as 'B' or 'C' in the B.C. Ministry of Forests *Scaling Manual*, is described for Douglas fir only, whereby the log makes the grade requirements for size, taper, grain, number and size of knots to be considered for making veneers for structural plywood. Spruce in HG/QCI is of sufficient strength and lightness that it makes excellent core or back-of-sheet veneers under or behind the facing of Douglas fir.

*Productivity*: as indicated by the site index (SI) for a stand, productivity is a measure of the potential volume of timber produced to the harvestable rotation age. Productivity is represented in reducing order as Good, Medium, Poor and Low and uses the Site Index as an indicator of an area's potential contribution to timber production.

*PTT*: the Provincial Technical Team, an amalgam of technical support people available to the Planning Forum from the natural resources ministries of the B.C. government. This includes the Ministry of Sustainable Resource Management, the Ministry of Water, Land and Air Protection, the Ministry of Energy and Mines, the Ministry of Forests and others on an as-needed basis.

*PTT analysis area*: The PTT has delineated 145 analysis areas to serve as reporting units, encompassing the LUP area.

*Sawlog*: has many definitions in the B.C. Ministry of Forests *Scaling Manual*, but is a term generally used to describe those logs that do not make the grade to be a peeler, but have less than 50% rot and enough size to make into some form of dimension lumber. If a log has more than 50% rot or not enough continuous undecayed wood of size in the remaining wood to make some form of dimension lumber then it is termed to be a "pulplog", or if it has no useable fibre it is classified as a "firmwood reject" and usually left on the harvested area as logging residue.

*Site index*: or SI, represents how tall on average a tree (by species) grows in a 50 year time period. The site index represents part of an equation that determines the potential timber production capability of a site. The production capability usually depends on factors such as the richness of the soil, availability of water, slope, aspect, climate and ecosystem.

*Stumpage:* Stumpage is the fee individuals and firms are required to pay to the provincial government to harvest timber on Crown Lands (per cubic metre). In the past, stumpage rates were based on hundreds of individual appraisals of timber stands, taking into account a number of factors affecting timber volumes. Currently, the province is establishing stumpage fees based on the timber's value on an open market (see *Market Pricing System*).

*Timber cruise:* inventory sampling a stand of trees for timber volume, species and grade.

*Timber harvesting land base (THLB):* the portion of the total area of a management unit considered to contribute to, and be available for, long-term timber supply. The harvesting land base is defined by reducing the total land base according to physical operability and economic operability (given current harvesting technology [ground-based, grapple, cable, and helicopter systems]) when markets are high, to describe the potential harvest from an area.

*Timber Supply Area (TSA):* is an area described by the Minister of forests with an Allowable Annual Cut determined by the chief forester and administered by the Ministry of Forests. The Minister allocates the available volume in the form of licences to tenure holders within the TSA in the form of Forest Licences, Pulpwood Agreements, Timber Sales, Woodlot licences, etc.

*Timber Supply Review (TSR):* the process by which British Columbia's Chief Forester determines allowable annual cuts for all management units (TFLs and TSAs) at least once every five years. The determination considers potential timber production, other forest resources, alternate rates of harvest, processing requirements, fire and pests, and economic and social objectives. Numerous sources of information contribute to the decision, including timber supply analysis; socio-economic analysis; public review comments (which address both analyses); and the social and economic objectives of the provincial government. This extremely complex process of AAC determination is then explained in a rationale statement that is publicly available.

*Tree Farm License (TFL):* TFLs are a type of forest tenure that conveys the nearly exclusive right to manage forests and to harvest an allowable annual cut (AAC) of Crown timber from the licence area, which may comprise private and Crown lands. TFLs carry the greatest management responsibilities of all tenure types, including inventories, protection of non-timber resources, strategic and operational planning, road building, reforestation, and silviculture. Licensees must use logging contractors for part of the volume harvested during a calendar year. TFLs have a term not exceeding 25 years and are replaceable every 5 - 10 years.

*Upset stumpage*: the minimum starting bid required to win the rights to harvest a cutblock.

*Weighted site index:* the sum of the product of all site indices multiplied by their hectarage, divided by the total area in that site index category.

E.g. if for poor sites, there are 25 hectares with site index 12, 30 hectares with site index 10, and 5 hectares with site index 14, the weighted site index is:

$$\frac{(25\times12) + (30\times10) + (5\times14)}{(25 + 30 + 5)} = 11.2$$